TANGYE BROTHERS AND HOLMAN,

LAURENCE POUNTNEY LANE, LONDON, E.C.,

SOLE MAKERS OF

MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH

HOLMAN'S NEW PATENT BRACKETED CROSS-BARS,

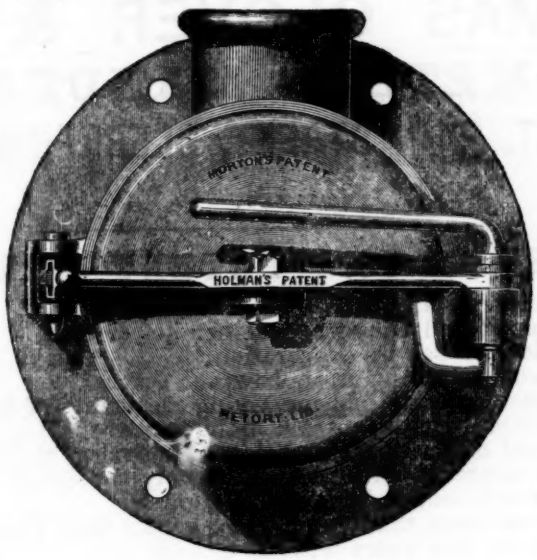
ANTI-FRICTION CATCHES, AND ECCENTRIC FASTENINGS.

NO LUTING.

NO DUPLICATE LIDS REQUIRED.

INSTANTANEOUS SEALING EFFECTED.

VERY DURABLE.



HOLMAN'S NEW SELF-SUSTAINING CROSS-BAR ENSURES FREEDOM OF JOINT, AND MAINTAINS PARALLEL POSITION OF THE LIDS.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested (rigid cast iron is now successfully employed), nearly 15,000 being in use at various Gas-Works in London and the Provinces, among which may be mentioned:—

The Gaslight Co., Beckton (where, by the end of 1875, nearly 4000 will be in use).
" Gaslight Co., Bow Common.
" Gaslight Co., Silvertown.
" Gaslight Co., Lupus Street.
" London Gaslight Co.
" Independent do.
" Phœnix do.
" South Metropolitan Gaslight Co.
" Commercial do.
" Imperial do.
" West Ham Gas Co.
" Gas-Works, Barnet.

The Gas-Works, Royal Arsenal, Woolwich.
" do. Lower Sydenham.
" do. Brentford.
" Consumers Gas Co., Woolwich.
" Alliance and Dublin Gas-Works.
" Edinburgh do.
" Manchester Corporation do.
" Salford do. do.
" Rochdale do. do.
" Liverpool Gas-Works.
" Birmingham do.
" Birkenhead do.
" Nottingham do.

The Newcastle-on-Tyne Gas-Works.
" Lurgan do.
" Carmarthen Gas-Works.
" Merthyr Tydfil do.
" Windsor do.
" Leeds do.
" St. Albans do.
" Over Darwen do.
" Rotherham do.
" Aylesbury do.
" Bournemouth do.
" Ystrad do.
" Cardiff do.
" Rochester do.

The Keighley Gas-Works.
" Aberdare do.
" Ballymena do.
" Richmond do.
" Stalybridge do.
" Longton do.
" Exeter do.
" Ross do.
" Falmouth do.
" Barrow-in-Furness do.
" Belfast do.
" Wakefield do.
And other Provincial and Foreign Gas-Works.

IMPORTANT TESTIMONIAL.

The Gaslight and Coke Company (Commonly called the Chartered Gas Company), Beckton, North Woolwich, July 2, 1874.

MESSRS. TANGYE BROTHERS AND HOLMAN.

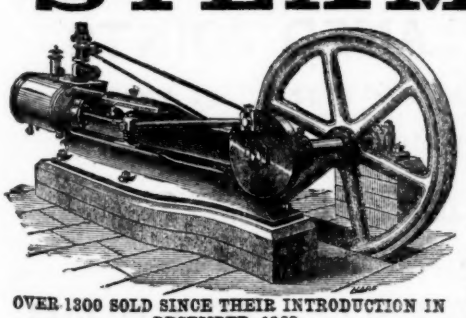
Gentlemen,—In answer to your inquiry respecting the Self-Sealing Lids, I beg to say that they continue to work well, and I have every reason to be satisfied with them.

I should be very sorry to return to the old system of Luting, and our stokers here freely acknowledge the benefit to them of the new system.

I am, yours truly,
(Signed) G. C. TREWEY.

TANGYE'S HORIZONTAL HIGH-PRESSURE EXPANSIVE

STEAM-ENGINES.



OVER 1300 SOLD SINCE THEIR INTRODUCTION IN DECEMBER, 1869.

In designing this Engine the utmost regard has been paid to simplicity of arrangement, strength of construction, and economy in cost. The working parts are considerably reduced in number, as compared with Horizontal Engines generally, rendering it far more durable and compact, the bed-plate, front cylinder cover, guides, and plummer-block for crank-shaft bearing being all cast in one piece, which in design and proportions is admitted by competent engineers to be perfect, and to afford a strength and rigidity that cannot possibly be attained in the best fitted engines of the ordinary horizontal type. The extraordinary stiffness of this Engine will permit of its being driven at a much greater maximum speed than engines generally, and with far less wear and tear. The cylinder with its valve-chest is bolted to the end of the bed. The cross-head slippers and connecting-rod ends are made adjustable, so that any wear can be readily taken up. The fly-wheel, cylinder-end, connecting-rod, and crank-plate, are all bright. All the parts are made to Whitworth's Gauges, and the material and workmanship are of the highest class throughout.

The Governor is of a very special description, and combines in the small space usually occupied by the ordinary steam stop-valve, a governor, throttle-valve, and stop-valve complete. It is exceedingly sensitive, simple, and compact.

These Engines are adopted in Gas-Works at Greenwich (Phœnix Gas Co.), Haggerston (Independent Gas Co.), Nine Elms (London Gas Co.), Falmouth, Harrow, Jersey, Plymouth, Richmond, Rochdale, Santiago (Chili), &c.

London 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS,

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON & CO.,

(SUCCESSORS TO SAMUEL CROSLEY,)

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

MANUFACTURERS OF PATENT

WET & DRY GAS-METERS,

STATION-METERS WITH PLANED JOINTS,

GOVERNORS, PRESSURE REGISTERS, GAUGES,

AND EXPERIMENTAL APPARATUS,

STREET-LAMP METERS,

AND REGULATORS FOR AVERAGE METER INDICATION.

METERS FOR MEASURING WATER.

CONTENTS.

Circular to Gas Companies:— PAGE
The Committee on the Regulations Bill . . . 749
The Annual Report of the Metropolitan Board of Works . . . 749
Unjust Accusations in *The Times* . . . 749
Gas Affairs at Hull . . . 749
Gas Affairs at Maidstone . . . 750
Opposition to Purchase at Southampton . . . 750
Success of the Colchester Company's Bill . . . 750
Mr. Malam's Process . . . 750
Results of the Average Meter System in St. Pancras . . . 750
The Coming Meeting of the British Association of Gas Managers . . . 750
Water and Sanitary Notes:—
Further Reports on the Future Water Supply of Liverpool . . . 750
Scarcity of Water at Wigan and Hindley . . . 751
Mr. Jabez Hogg on River Pollution . . . 751
Communicated Article:—
The Purification of the Seine . . . 751
Leading Article:—
A Treatise on the Science and Practice of the Manufacture and Distribution of Coal Gas . . . 752
Correspondence:—
Buenos Ayres Gas Company . . . 754
Proposal to Invite Ladies to the Gas Managers Excursion . . . 754
Parliamentary Intelligence:—
Progress of Bills in House of Commons . . . 754
House of Lords Committee—Colchester Gas Bill . . . 754
House of Commons Committee—Newport (Monmouthshire) Gas Bill . . . 755
Legal Intelligence:—
Court of Chancery—*Re* The Foreign and Colonial Gas Company . . . 757
Knaresborough Petty Sessions—Obstructing a Gas Company's Officers in the Removal of a Meter . . . 757
Northallerton Petty Sessions—Summons for Discharging Gas Refuse into a River. 758
Miscellaneous News:—
Brighton and Hove Gas Company . . . 752
Death of Mr. Jabez Church, C.E. . . . 754
Portishead District Water Company . . . 754
Metropolis Water Supply . . . 758
River Pollution, with Special Reference to the Impure Water Supply of Towns . 758
Metropolis Gas Supply . . . 764
Unjust Accusations against the Metropolitan Gas Companies, and their Refutation 765
Stonehaven Gas Company . . . 766
Meeting of the Bombay Gas Company . . . 766
Hull Gas Supply . . . 767
West of Scotland Association of Gas Managers . . . 769
Iron and Coal Trades of Sheffield, South Yorkshire, and North Derbyshire . . . 770
Iron and Coal Trades of South Staffordshire and East Worcestershire . . . 770
Iron and Coal Trades of Lancashire . . . 771
Coal and General Trade of the North . . . 771
Trade Notes from Scotland . . . 771
Maidstone.—Proposed Purchase, by the Town Council, of the Gas-Works . . . 771

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 25, 1875.

Circular to Gas Companies.

THERE is not much to be said this week about the Regulations Bill. Sir Charles Adderley has nominated Mr. W. E. Forster (Bradford), Mr. J. G. Talbot (West Kent), and Mr. Bristowe (Newark), as members of the select committee. There are two others to be nominated by the Committee of Selection. This committee, we believe, only meet once a week, on Thursday, so we shall have to wait a few days to learn the complete constitution of the select committee. It may be expected that, as soon as the committee is formed, no time will be lost in getting to work, and we have little doubt that the inquiry will be entered upon within the next fortnight. When it will close, we shall not venture to prophesy. If the committee agree with the Chancellor of the Exchequer, and strike out the objectionable part of clause 6, putting at the same time a higher standard price, and proceeding on the lines of the legislation of 1868–69, the inquiry need not be a long one; for, as a rule, the companies do not object to "regu- "lations." They do complain of the injustice of being dragged before Parliament against their consent, and in opposition to the principle laid down by Lord Cardwell's committee, which, we venture to think, will be supported by the present committee. But the companies are willing to submit to all such general regulations, however unnecessary we may think them, as will protect the interests of consumers, while their own guaranteed rights are preserved.

The annual report of the Metropolitan Board of Works, an extract from which we publish in another column, was of necessity written before the fate of two of the Gas Bills promoted by the Board could be known. It will be seen that the Board rest the defence of their proceedings on the recommendations of the committee of 1867, many of which were disregarded by the committee of the House of Commons who sat in 1869. No doubt the Board are perfectly right. It was suggested by the previous committee that the metropolitan authorities should have the power to set up independent works, if the companies did not accede to general regulations. At the same time, that committee distinctly declined to do what the Corporation and Metropolitan Board then wanted, and, indeed, want to-day, "on the ground "that a compulsory and unconditional interference with the prices "already conceded to a producer, is not the weapon by which "Parliament is accustomed to secure the rights of the consumer." As the companies came for fresh powers, they were to be subjected to new restrictions, and to this, as shown in the instance of the Commercial Company this year, they have not objected. We shall probably hear a good deal about the report of 1867 in the course of the proceedings now about to commence. It in no way binds the present committee; but if any legislation result from the inquiry now to be entered upon, we shall be greatly astonished if it essentially differs from that which came of the 1867 report, and which, it must be remembered, was acquiesced in by the authorities who are now once more harassing the companies.

The Metropolitan Board are evidently not over sanguine. They scarcely hope to remove, and apparently will be content to lessen, what they call the grievances of gas consumers and ratepayers. From our point of view, we fail to see what grievances gas consumers suffer from, other than those which all feel, who cannot get things as cheap as they could wish.

It is satisfactory to see that the Board fairly acknowledge that the companies, under their supervision, have fully satisfied the requirements of the Acts of Parliament, and the prescriptions of the referees, except on a very few occasions, and then owing to accidental causes.

The profit made by the Board on meter-testing, under the Sales of Gas Act, amounted last year to £566, which about half paid the expenses of gas-testing. If the Bill now under consideration should pass, it will involve the Board in much larger expenses for gas-testing.

It is seldom we notice anonymous correspondence in other journals, but a letter which has obtained a wide circulation, and was admitted to and commented on in the City article of *The Times*, demands a few remarks. The "Londoner" who writes the letter is evidently ignorant, and somewhat malicious. Both he and the "City Editor" have been sufficiently answered by letters which we publish elsewhere. The "City Editor," possibly better acquainted with the process of raising foreign loans, which involves the payment of a large commission to the monetary agents, and seldom yields anything to investors, no doubt looks with abhorrence on gas companies, who, on the strength of a legitimate business and a parliamentary guarantee, can raise any amount of money, without resorting to a financial agent and paying a 25 per cent. commission. Still that does not excuse his lamentable ignorance of the conditions under which gas is actually supplied in the metropolis. He certainly ought to have known that the accounts of all the companies are published every year, and that those of three companies, whose united capital amounts to more than two-thirds of that of all the metropolitan companies together, are under the strictest supervision. The "City Editor" probably never heard of Mr. Parkes, whose visits to the companies offices are never unwelcome. In the City they know little of "official" auditing until a concern gets into bankruptcy.

As regards the "substantial deposits" which some companies are said to require, we need only remark that the amount of money held by the metropolitan gas companies as security is relatively exceedingly small, and that losses by "bad debts" are very considerable. The loss from this source to the Commercial Company in 1873 reached nearly ½d. per 1000 feet of gas sold. In the same year the Chartered Company lost £3579, and the Imperial £4257. It is quite true that the sums held as deposits do not appear in the accounts of the companies, nor is it necessary that they should; but, however the money is employed, whether it be deposited in a bank or used as working capital, it is clear that the earnings of it must come to the general consumer, if not to the individual depositor. It may be said, further, that any metropolitan depositor can have interest for his money if he set the right way about getting it. Our readers will remember that we have suggested the universal exaction of security, and the payment of interest, which would partly convert a company into a co-operative concern.

We are glad to see the illusion respecting an official reduction in 1857 of the capital accounts of the water companies, dispelled. The assertion that such a thing occurred was put forward in the pamphlet recently published by Mr. Frith (probably the "Londoner"), and when reviewing his book we had not the means of contradicting the statement. The matter is now, however, effectually cleared up, and in the next edition of his pamphlet we hope that Mr. Frith will represent the transaction in its true light.

Hull is in something like the same position as the metropolis in regard to the gas supply. There are three companies supplying separate districts, and all under different conditions. The British Company may charge 5s. per 1000, and supply 10-candle gas; but, as a fact, they furnish 16-candle gas, and charge only

2s. 6d. The Kingston-upon-Hull Company are unrestricted in any respect; they can make what gas they please, and charge what they like for it, but they also supply 16-candle gas, charging, however, 4s. 6d. The Sutton and Southcoates Company are bound to supply 14-candle, but actually give 16-candle gas. They may charge 4s. and 4s. 6d., which they do. It is no wonder, then, that the inhabitants of Hull feel as the people on the south side of the Thames feel, and wonder why gas cannot be supplied at one uniform price. The companies, of course, desire to remain as they are, but the Corporation of Hull are very anxious to interfere in some way. They would set up competing works if they could, and they might purchase, if the Borough Funds Act did not stand in their way. Their law clerk, in this difficulty, recommends them to petition in favour of the Public Health Bill, and praying for the insertion of an addition to clause 160 of the amended Bill, empowering corporations and urban sanitary authorities to build competing works, and to raise the funds necessary for the purpose, "free "from the objectionable liabilities of any existing company." We do not see what is exactly meant by the latter part of this sentence. If the Public Health Bill should pass, we have little doubt that this 160th clause will be retained, and we have no fear that the addition proposed by the law clerk of the Corporation of Hull will be made. "The Corporation may," says their law clerk, "apply to Parliament next session for an Act "enabling them to purchase;" but, if they wish to succeed, we may remark, they had better first of all arrange terms with the companies. In the meantime, as they have power to become shareholders in the Kingston-upon-Hull Company, they had best make a beginning by purchasing all the shares, and show their constituents if they can manage a gas undertaking as well as they can a water undertaking.

The Town Council of Maidstone are itching to get possession of the gas undertaking. There is scarcely any complaint made against the company, whose greatest offence seems to be the unpardonable sin of making profits and paying dividends. Yes, the accusation is brought forward that they have made extensions and improvements with profits instead of capital. We believe this practice to be wrong; but, after all, consumers are not much prejudiced. There is further, we should say, an allegation that the illuminating power of the gas hardly exceeds, and, indeed, is sometimes below, 10 candles. This assertion is scarcely worthy of notice, and will, we are certain, receive an emphatic contradiction. We mention it because we believe the quality of the gas has been shamefully misrepresented. Mr. West is far too skilled and honest a manager to fail in his duty, and we are certain the directors would never sanction so gross a violation of their obligations. It is fair to say that the attack on the company was made in a very gentlemanly spirit. We gather from the debate that the directors are not unwilling to sell, and that at an absurdly cheap rate; but we fancy there must be some mistake in the figures of the amount announced as the directors price. If any gas company were ever entitled to 25 years purchase, most certainly the Maidstone Company are. The following resolution was carried unanimously at the meeting of the council, shareholders and one director of the company voting for it:—

That a committee be appointed to inquire into the quality, price, and supply of gas, for the borough of Maidstone; also to take into consideration the desirability of considering the provisions of the local Act and the incorporated Gas-Works Clauses Act, and the desirability of approaching the directors of the gas company with a view of acquiring the gas-works; and to report thereon to a future meeting of the Town Council.

Whether, when the bargain is concluded, the ratepayers of Maidstone will be as disgusted at the action of the Corporation as those of Southampton, it is impossible to say. At the latter town the Chamber of Commerce have made a fainthearted move in opposition to the purchase, in the face of a detailed statement made at the meeting, by a very competent authority, showing that the acquisition of the undertaking at the price agreed upon would prove very advantageous to the town. We have no doubt Mr. Le Feuvre is correct, and believe that the purchase of the works, with the risk that some new invention may, in the course of time, supersede the use of gas—a thought that alarms some people—would be a safer investment than the purchase of the docks, with the possibility that the great companies who chiefly use them, may, in a few years, make Falmouth their packet station. The ratepayers, too, have held a meeting, and are raising subscriptions to support an opposition in the Lords. As we said last week, we fear it comes too late, for we should greatly prefer that the undertaking remain in the hands of the company.

The ill-advised opposition to the Bill of the Colchester Company, before the Lords, was, it will be seen by our report in another column, quickly disposed of. Without calling for any reply to the evidence brought forward by the Corporation against the Bill, the committee unanimously passed the preamble and the clauses as settled in the Commons.

So much interest is felt in the success of every process which promises to increase the yield of gas from coal, and at the same time to secure other advantages, that we are certain great attention will be given to the report we publish of the discussion on Mr. Malam's process, at the recent meeting of the West of Scotland Association of Gas Managers. There is, we are sure, no desire on the part of his brother managers, nor of our correspondent, "Lesmahagow," to do more than ask for a clear and satisfactory demonstration of the fact, that the process will give from 1000 to 2000 feet more gas per ton. The point will, we have no doubt, be settled, one way or the other, by the experiments made, or about to be made, by Mr. Foulis, of Glasgow, whose competence and conscientiousness no one will dispute.

The chairman of the Lighting Committee of the Vestry of St. Pancras has reported on the results of the average meter system, which has been in operation in the parish for half a year. It is hardly necessary to say that the working of the system has proved eminently satisfactory. The report is full of compliments to every one concerned in the matter, including the Imperial Company, "who have afforded every assistance and information to "the vestry clerk, &c." It is calculated by the chairman that an annual saving of £2175 will result to the parish from the adoption of the system. This statement has, of course, put the vestry in a very good humour, and they and the company, when the little dispute about a charge for lamps not in existence is settled, will, no doubt, go on amicably.

The twelfth annual meeting of the British Association of Gas Managers commences at Leeds on the 8th of June. The papers to be read are all of interest, and the subjects of some are of much importance. Unfortunately, the list reached us too late for further notice this week. The lecture is to be delivered by Mr. A. V. Harcourt. All who are strangers to the locality will be certain to enjoy the projected excursion.

Water and Sanitary Notes.

THE question of the future water supply of Liverpool still greatly perplexes the Corporation. Mr. Jackson has recently submitted to them a modification of his Bleasdale scheme, and the Water Committee again resorted to Messrs. Hawksley and Bateman for their opinions, which are given in two reports now noticed. Mr. Hawksley expresses an unqualified approval of the modified scheme, which is divided into two parts—(*a*) relating to the head waters of the rivers Brock and Calder, and (*b*) relating to the head waters of the river Wyre, which may be taken separately or together. The scheme (*a*), Mr. Hawksley calculates, will yield, during a minimum rainfall, a daily supply of 13½ millions of gallons, the whole of which may be taken to Liverpool if compensation be given in money instead of water. If, however, compensation be given in water, the daily supply to Liverpool will be reduced to nine millions of gallons. Mr. Jackson's estimate of the cost of this undertaking amounts to £1,040,017, and Mr. Hawksley considers this a sufficient and liberal estimate.

The project (*b*), Mr. Hawksley calculates, will yield upwards of 13 millions of gallons per day. The estimated cost of the work is £1,201,047, if it be constructed separately or in substitution for (*a*); but, if the two be combined, a saving of £70,000 may be expected. The combined project is anticipated to yield Liverpool 26 millions of gallons per day, at a total cost of £2,171,064, or little more than £83,000 per million gallons. If, however, water compensation be given, the cost to Liverpool may be raised to £100,000 per million gallons.

Mr. Hawksley calculates that Liverpool will not require more than 31¼ millions before A.D. 1904, and as the project (*a*), with the existing works, will afford 32 millions of gallons, it may be considered unnecessary to construct the project (*b*) for many years to come, except, perhaps, such portions as may be necessary to give compensation. It is recommended, however, that efforts should immediately be made to obtain the sanction of Parliament for the combined schemes, and that project (*a*) be proceeded with as soon as legislative powers are procured, so that the supply may become available, if possible, in 1881.

Mr. Bateman's estimates of the quantity of water to be obtained, and of the cost of execution, do not differ greatly from those of Mr. Jackson, endorsed by Mr. Hawksley. He calculates that the combined scheme, if money compensation be given for Bleasdale water, will afford Liverpool a daily supply of 25 millions of gallons per day, for an outlay of £2,716,000, and the cost of filtration (capitalized) being added, Mr. Bateman estimates the total cost of 25 millions of gallons per day at £2,871,047. He then proceeds to compare the cost of this project with that of his favourite Ullswater scheme if carried out jointly with Manchester in equal proportions. The first 10 millions of gallons per day from Ullswater he estimates will cost Liverpool £1,815,256; the

second 10 millions, £605,417, making a total outlay of £2,420,703 for a daily supply of 20 millions of gallons.

The cost of each succeeding 10 millions up to 40 millions of gallons is estimated at from £600,000 to £700,000. According to these estimates it would seem that the only advantage to be obtained by going to Ullswater is the apparent inexhaustibility of the supply.

As regards the future wants of Liverpool, Mr. Bateman calculates that 23 millions of gallons will be required in 1884, and that, from this year forward, the annual necessary increase must be taken at one million gallons per day. The present available daily supply is 17 millions of gallons. If Bleasdale be added, there will, in 1884, be a total of 30 millions, showing a surplus of seven millions, which will be exhausted in seven years; so that as soon as the Bleasdale project (*a*) is completed, it will be necessary to commence the execution of project *b*, and then all the sources combined can only be expected to last out the wants of Liverpool for the next 27 years. Thus, according to Mr. Bateman, two courses are open to the Corporation; they may go on eternally constructing waterworks, or once and for all adopt his Ullswater scheme.

The water, of course, continues to fall in the existing reservoirs, and, at a meeting of the Water Committee last week, the chairman announced that they were within three weeks supply of the position they were in during 1865, when the town was placed on a consumption of three hours per day; and he added that, in case of a drought this year, followed by a low rainfall next, the Corporation would be driven to rely on the wells for a supply. A proposal has been made to sink 20 more wells in the neighbourhood, but this project, strongly supported by Mr. Alderman Bennett, is emphatically condemned by Mr. Bateman.

In Wigan and the surrounding district there is a great scarcity of water. At Hindley the Local Board have obtained water-carts, and are selling the water in the streets.

We publish to-day a paper read by Mr. Jabez Hogg, at the Society of Arts, on "River Pollution, with Special Reference to "the Impure Water Supply of Towns." It will be seen to abound in all the exaggerations usually indulged in by enthusiastic sanitarians, and is illustrated by the pictures, familiar to us from our boyhood's days, of the marvellous contents of a drop (?) of water. We have no space to-day for further notice of the paper, but we may call special attention to the remarks of Mr. Rawlinson, who took the chair on the occasion. Mr. Rawlinson repeated what has often been said in these columns—viz., that if there were the smallest truth in most of what is alleged respecting the effects of drinking impure water, the globe must long ago have been depopulated. In fact, it may be doubted whether any of the higher organisms could ever have existed, and the sole tenants of this earthly sphere must have been *trichinæ*, *bacteria*, and such like small deer.

Communicated Article.

THE PURIFICATION OF THE SEINE.

(FROM OUR PARIS CORRESPONDENT.)

REPORT OF THE COMMISSION CHARGED WITH PROPOSING THE MEASURES TO BE TAKEN FOR REMEDYING THE POLLUTION OF THE RIVER SEINE AT THE APPROACHES OF PARIS.

This commission, which was appointed by a decree of the Prefect of the Seine, bearing date the 22nd of August, 1874, have just presented their remarkable report upon a question which interests in a very high degree not only the inhabitants of the department of the Seine, but also those of every large city in the universe.*

After having established the fact of the pollution of the Seine at the approaches of Paris, and sought the causes of such pollution, the report enters upon an examination of the choice of measures to be taken to remedy it.

We are about to pass in review the different parts of this report, summarizing its most important points.

The commission state that above Paris, and in the course of its passage through the capital, as well as between the fortifications and Asnières, the Seine presents a satisfactory appearance, at least upon a simple superficial inspection. The progress made by the great work of the canalization and sewerage of Paris manifests itself in a very striking manner. Fish live in the entire breadth of the river, vegetation of a high order grows upon its banks, and its bed is composed of white gravel.

Below the bridge at Asnières the situation suddenly changes. On the right bank of the river is to be found the outlet of the Clichy main sewer, from which a considerable current of blackish water issues, diffusing itself into the river in the form of a parabolic curve, the extent of which varies according to the season. This water has a very repugnant aspect, being charged with all kinds of organic *débris*—vegetables, corks, skins, hair, dead bodies of domestic animals, and such like. It is usually covered with a layer of greasy matter, which, following the direction of the wind, accumulates upon one or the other bank of the river. A greyish mud, mixed with organic *débris*, collects all along the right shore, forming banks of alluvium, which, at certain periods of the year, project considerably above the water, and only disappear after costly dredging operations have been undertaken. This mud descends into the navigable channel of the river, and is the seat of an active fermentation, manifesting itself in the form of numberless gas bubbles, which burst at the surface of the water. Under very great heats these gas bubbles attain a diameter of from 1·0 to 1·5 millimètre. In disengaging themselves from the mud they carry it away, and draw to the surface black and infectious matters, which afterwards travel along openly with the current.

No living being, no fish, no green vegetable is to be met with upon the right bank of the river; in the middle of the stream, however, fish begin to appear, and they are also found upon the left bank. On occasions of very heavy storms, when the current of sewer water invades the entire breadth of the river, fish may be accidentally destroyed, even in the localities they usually frequent, in consequence of the general and temporary contamination of the water. This contamination diminishes in proportion as the distance from Asnières is increased; the mud at the bottom of the river, which at Clichy attains a thickness of from 2 to 3 mètres, being only 65 centimètres thick at St. Ouen. On reaching the first houses in St. Denis, the manufactories commence by pouring in a recrudescence of infection in the shape of a considerable amount of refuse matters proceeding from industrial operations. But their action is trifling compared with that of the departmental sewer which discharges its contents within a few paces of the St. Denis suspension bridge. This sewer pours out a fluid which is absolutely black and fœtid, the odour of ammonia being very strongly marked; its entire surface is covered with a scum, and gas bubbles are disengaged on all sides. This state of things continues with a scarcely varying intensity to a point opposite the village of Epinay. The bed of the river for the whole of this distance is covered with a black mud, stinking and glutinous, peopled with reddish worms, which are to be found only in the most polluted cesspool waters. Periodically this mud emerges to the neighbourhood of the mouth of the sewer, and should be cleared away by dredging.

The intensity of pollution and colouration disappears little by little in the river. At St. Germain and Maisons-Laffitte, however, the water is still turbid, whilst its flavour is but little agreeable. After the confluence of the Oise, the Seine recovers in appearance a condition sensibly analogous to that in which it was found above the main sewers, and at Meulon all outward trace of pollution disappears.

The commission have not stopped at this simple description of the aspect actually presented by the Seine at the approaches of Paris; they have thought it necessary to add to the description of outward appearances a few matters borrowed from more scientific researches.

In order to ascertain the state of pollution in which the river was, the commission endeavoured to find out the amount of nitrogenous organic matters not yet transformed into ammonia, that the waters were capable of holding at different points. This determination showed what was the true pollution of the river, by indicating precisely what matters are still susceptible of fermentation. The estimation of oxygen formed the complement of these first researches, which determined the intensity of the fermentation already produced, measured the final result of the reaction accomplished; and the two processes were made complete by the light they threw upon each other.

The following table gives a summary of the determinations made:—

Spot where Sample of Water was taken from the Seine.	Organic Nitrogen in Grammes per 1000 Litres of Water.	Total Nitrogen, including Ammoniacal Salts, in Grammes per 1000 Litres of Water.	Dissolved Oxygen in Cubic Centimètres per Litre of Water.
Pont d'Asnières, above sewer outfall.	0·85	1·5	5·34
Outfall of Clichy sewer	..	29·5	..
Clichy, below outfall, right bank of river	1·51	4·0	4·60
Ditto ditto middle of river	1·28	..	
Ditto ditto left bank of river	1·25	..	
St. Ouen, right bank	1·16	2·0	4·07
St. Denis, above sewer outfall	..	2·0	2·65
Outfall of departmental sewer	..	98·0	..
St. Denis, below sewer outfall.	7·27	7·0	1·02
Epinay	1·26	3·0	1·05
St. Germain	0·76	2·2	..
Maisons-Laffitte	0·79	2·5	3·74
Poissy	0·45	2·2	6·12
Mantes	..	1·4	8·96
Vernon	..	..	10·40
Rouen	..	..	10·42

It results from the above figures that the water of the river is deeply impregnated with fermentable organic matter in all its length, from Clichy to St. Ouen and St. Denis, and in this respect it does not return to the condition in which it was found at Asnières until it reaches the neighbourhood of St. Germain; that at this latter point it is still charged with nitrogenous mineral matters; that besides this the water, deprived progressively of its oxygen as far as the extremity of the Isle of St. Denis, preserves an absolutely insufficient aëration as far as St. Germain, does not recover its

* The commission represents the Department of Public Works, the Prefecture of the Seine, and the Prefecture of Police, and is composed of the following gentlemen:—MM. Kleitz, Inspector-General of the Ponts et Chaussées, president; Chatrey, Inspector-General of ditto; Krantz, Engineer-in-chief of ditto; Belgrand, Inspector-General of ditto, Director of the Waters and Sewers of Paris; Alphand, ditto, Director of Works of Paris; Mille, Inspector-General of the Ponts et Chaussées; Vaudrey, Engineer-in Chief of ditto; Callon, member of the Municipal Council of Paris; Dr. Depaul, ditto; Chevalier, member of the Council of Health; Boudet, ditto; Alfred Durand-Claye, Engineer of the Ponts et Chaussées, secretary and reporter.

original standard of purity till it reaches a point beyond Maisons-Laffitte, and only becomes of good quality when near Meulon. At this point the water becomes at once regenerated by the transformation of its nitrogenous organic matters into mineral matters, and by the recovery of the oxygen it had lost by fermentation.

The facts ascertained from a simple superficial observation are thus confirmed by scientific data.

The commission considered that they ought not to close the scientific examination of the fouling of the Seine below the main sewers without turning their attention to the gases given off in fermentation, the abundant production of which they had noticed from Clichy to the extremity of the Isle of St. Denis, in precisely that portion of the river where the greatest absorption of oxygen takes place. An analysis of this gas gave the following results :—

Protocarburetted hydrogen	72·88
Carbonic acid	12·30
Carbonic oxide	2·54
Hydrosulphuric acid	6·70
Various	4·58
	100·00

The gas burns with a bluish flame, and, beyond the asphyxiating elements contained in it, it possesses poisonous properties; in fact, a small animal introduced into a bell filled with gas perished instantaneously. But as the liberated gases are immediately diluted with a considerable volume of air, the commission are of opinion that in the actual condition of things there is nothing to lead to the belief that the gases evolved from the Seine have an immediate and direct action upon the public health. For the rest, it is obvious that every system applicable to the purification of the river will necessitate the withdrawal of the polluted water from the actual course of the stream, and thus cause the disappearance of the elements of fermentation, and, consequently, the mephitic gases resulting from it.

The study of the condition of the river clearly shows what are the predominant causes of its contamination. They are evidently the influx of the sewer waters of Paris. The drainage system of the city, which, in the year 1856, was only 160 kilomètres (about 100 miles) in extent, now comprises 573 kilomètres (about 355 miles), and, including its annexes, reaches a total length of 771 kilomètres (about 480 miles). This vast network of sewers collects the rain-water and house slops, the flowings from the public urinals, a portion of the street sweepings, and such like.

The two outfalls at Clichy and St. Denis pour into the Seine a mean volume of 260,000 cubic mètres (about as many tons English) of sewage daily, or at the rate of nearly 3 cubic mètres per second. This gives a total of 95 million cubic mètres of polluted water poured yearly into the Seine. Of this quantity four-fifths are discharged at Clichy and one-fifth at St. Denis. Each cubic mètre of sewage water discharged at Clichy contained on the average 1·28 kilogrammes (2¾ lbs.) of solid matter, and that discharged at St. Denis 1·54 kilogrammes. (3½ lbs.) Every year, therefore, the Clichy sewer encumbers the bed of the Seine with 100,000 tons of solid matter, and that at St. Denis with 25,000 tons; together, 125,000 tons. These deposits are not only inconvenient as encumbering the bed of the river, but they contain from 10 to 25 per cent. of organic matter, with 0·4 to 0·6 kilogramme per cent. of nitrogen. They are, therefore, susceptible of undergoing the ulterior decomposition which the Seine water manifests. For the rest, they contain only a fraction of the decomposable elements brought down by the main sewers, the total quantity of sewage water discharged at Clichy containing, beyond the 1·28 kilogrammes of solid matters, 0·82 kilogramme of dissolved matters; the whole representing a weight of 2·10 kilogrammes per cubic mètre. This is found on analysis to contain—

Nitrogen	0·04 kilo.
Organic matters, chiefly volatile or combustible	0·66 ,,
Mineral matters	1·40 ,,
Total	2·10 kilos.

At St. Denis, to the 1·54 kilogrammes of solid matters are added 1·92 kilogrammes of dissolved organic matters, making together 3·46 kilogrammes, which on analysis were found to contain—

Nitrogen	0·14 kilo.
Volatile or combustible matters	1·38 ,,
Mineral matters	1·94 ,,
Total	3·46 kilos.

The influence of nightsoil matters exhibits itself here by an amount of nitrogen 3½ times greater than at Clichy, and a double quantity of volatile and combustible matter.

It is useful to remark that the total delivery of the river at low-water mark is only 45 mètres, being only 15 times the discharge from the main sewer.

It would be unjust not to add that the large sewers drain Paris and the most populous parts of the Parisian agglomeration—namely, Sèvres, St. Cloud, Neuilly, Courbevoie, &c.—and concentrate the pollution of the sewage waters without augmenting it, thus affording the possibility of remedying their characteristic inconveniences.

(To be continued.)

BRIGHTON AND HOVE GAS COMPANY.—At the ordinary monthly meeting of the Hove Commissioners on Thursday last, a report was presented from the Legal and Parliamentary Committee, stating that they had considered the question of petitioning against the application of the Hove Gas Company for a Provisional Order for permission to enlarge or increase their storeage works in Hove. The report stated that the committee had come to the decision that, as the houses there had been built up to the gasholders, an opposition on the ground of unsightliness and bad smells would necessarily be weak, unless supported by considerations of higher importance; and that they found that doubts existed as to whether the storeage of gas in gasholders could be considered dangerous, no instance of an explosion of gas so stored having actually occurred. The commissioners decided upon not opposing the company's application.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

LXIV.

GASHOLDERS.

This week we present engravings of a half section of a tank, and a fourth part of the plan of the same, as designed and constructed by Mr. Kirkham for the Imperial Gas Company at their new and extensive works at Bromley. We have been favoured by that gentleman with the working drawings, of which there are seven sheets, conditions, and specification of construction. We regret that our space does not permit of more justice being done to the drawings; of the conditions we give an abstract; and the specification is copied almost verbatim. These latter are so clear and definite that any practical man could execute the work without reference to the drawings, and we believe that they cannot fail to be instructive to the practical reader, indicating as they do the method and means adopted in the construction of works of this description, and of extensive magnitude.

Abstract of Conditions.

Intending contractors are invited to examine the ground and situation where the tanks are to be constructed, in order to ascertain the facilities or disadvantages that the locality and premises may offer.

The company is not to be held responsible for the accuracy of the drawings, so far as regards the depth of clay, or nature of the soil where the work is to be executed, the intending contractor must, at his own expense and cost, ascertain for himself all the particulars on those points necessary for the execution of the work.

The tanks to be terminated within eight months from the date of contract; at the end of that period they shall be delivered in a complete and perfect state to the company.

Payments to be made monthly as the work proceeds, according to the certificates of the company's engineer, in the proportion of 80 per cent. of the work actually done, and the balance to be paid within two months of the final completion of the whole as certified by the company's engineer.

The persons whose tender shall be accepted to enter into a bond with two sureties, conjointly and separately, to be under a penalty of £2000 for the due performance of the contract, agreeably with the conditions expressed.

The contractor to execute in the most approved manner, and with materials of the best quality, all the work defined by the company's engineer under the contract, and shall conform minutely to all the drawings, designs, and specifications, and instructions of the engineer, and not to execute any extra work whatever, without authority specially given in writing by the engineer.

Should the work not be proceeded with sufficient speed, the engineer shall give twelve hours notice in writing of his dissatisfaction with the progress of the work, whether arising from the want of sufficient men, materials, implements, machinery, engines, pumps, &c., and if this notice be not attended to within 24 hours, the company's engineer shall be empowered to procure extra men, materials, &c., as he may deem essential for the completion of the work at the cost of the contractor.

The contractor to reconstruct any imperfect work, or executed with unsound materials, or not in accordance with the drawings. All bad materials shall be rejected and removed from the company's premises upon a written order being given by the engineer.

The contractor to supply all the materials of the best quality, and all labour, implements, tools, scaffolding, planks, timber, carts, barrows, in short, all material or thing necessary for the proper execution of the work, all of which are to be considered included in the tender given by the contractor.

The contractor to be responsible for all damages whatsoever that may arise from the construction of the work, and for all the cost of excavation, shoring, timbering, and shall not obstruct the operations of the company during the progress of the works, and to be held responsible for all losses, pains, and penalties that may arise from such hindrance.

The whole of the excavation, shoring, timbering, making good all damage, filling in and ramming ground at the back of walls to be considered included in the tender given by the contractor.

The engineer shall have the authority to direct the removal of any foreman or workman that may be employed upon the works, for incapacity, or for wilful neglect or improper conduct, upon stating to contractor the grounds of objection.

The contractor to sink a temporary well, and to furnish engines, pumps, and machinery to keep the excavation clear of water during the whole of the operations.

The contractor may be called upon to execute additional works by the engineer, or to omit some, as in his judgment may appear necessary, such additions or omissions are not to vitiate the contract, but to be valued and paid or deducted according to scale of prices affixed. No extras will be admitted unless the written order of the engineer is produced.

Specification for the Construction of two Brick Tanks and Wells erected at the Bromley Station of the Imperial Gas Company.

The tanks to be each 203 feet in diameter in the clear, and 38 feet in depth from the bottom of the footings to the top of the curb.

Excavation.—The earth shall be excavated by cutting a trench 14 feet wide over the whole circumference of the tank down to the clay; the trench to be then excavated 10 feet wide down to the bottom of the footings, leaving benchings on the top of the clay. This trench to be extended where necessary at the back and sides of each pier, so as to leave room for 2 feet of puddle when the walls and piers are complete. The earth shall then be excavated for 22 feet for the construction of the well, or the footings of which shall be 8 feet deeper than the footings of the tank. When the tank and well walls are carried up to the surface of the level of the present ground, the whole of the ground shall then be taken out of the interior of the tank down to the blue clay, when it shall be excavated round the sides, to form the cone represented in drawing.

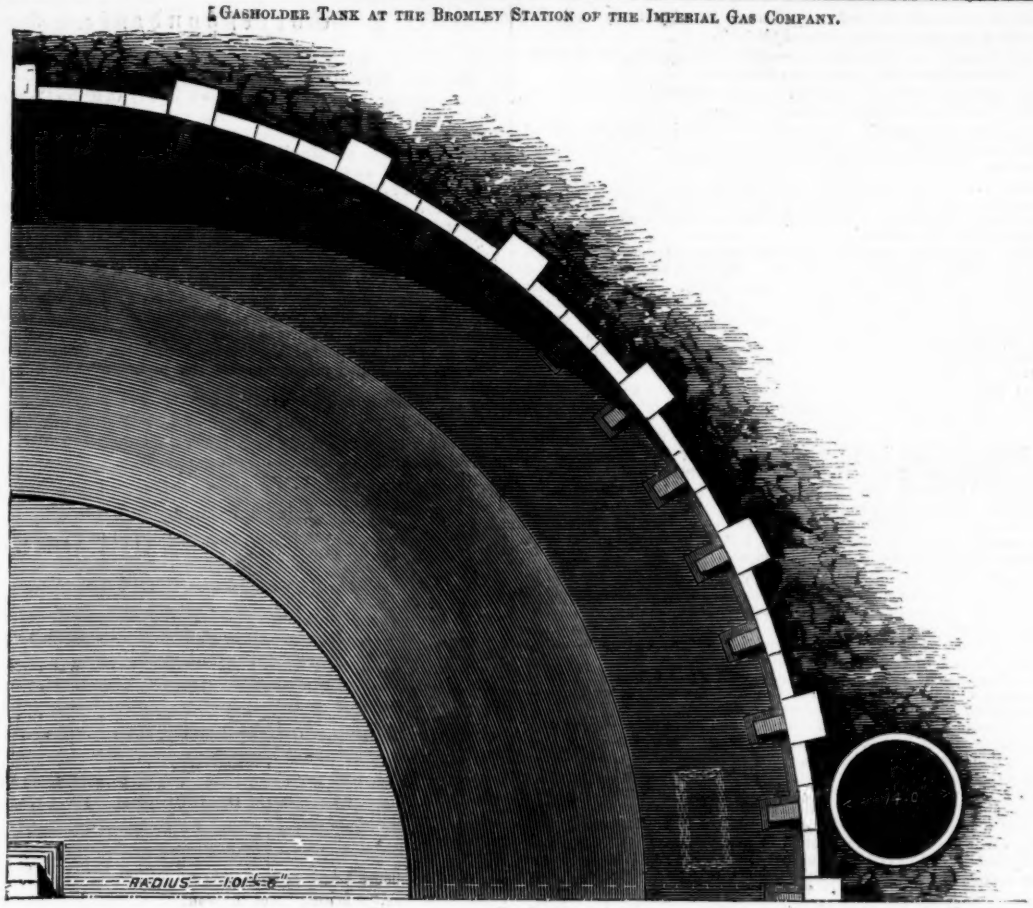
Brickwork.—The whole to be of the best hard stocks, &c., &c. The bricks shall be laid closely; the courses to be headers and stretchers alternately, and well bonded, the joints being broken in a careful and regular manner, every joint being carefully rubbed up and flushed with mortar the whole breadth of the wall. No four courses of bricks shall be more than 12 inches in thickness. The whole of the inner surface of the brickwork to be of an even and fair surface, and worked to a true circle. Should it be discovered that any of the walls are out of upright, or out of level, or not to a true circle, such defects shall be rectified at the sole cost of the contractor.

The brickwork shall at no time be carried up more than 3 feet in height before the ring or circle shall be completed. All the bricks for the several operations shall be laid down on the scaffold in a careful manner, so as to avoid breakage.

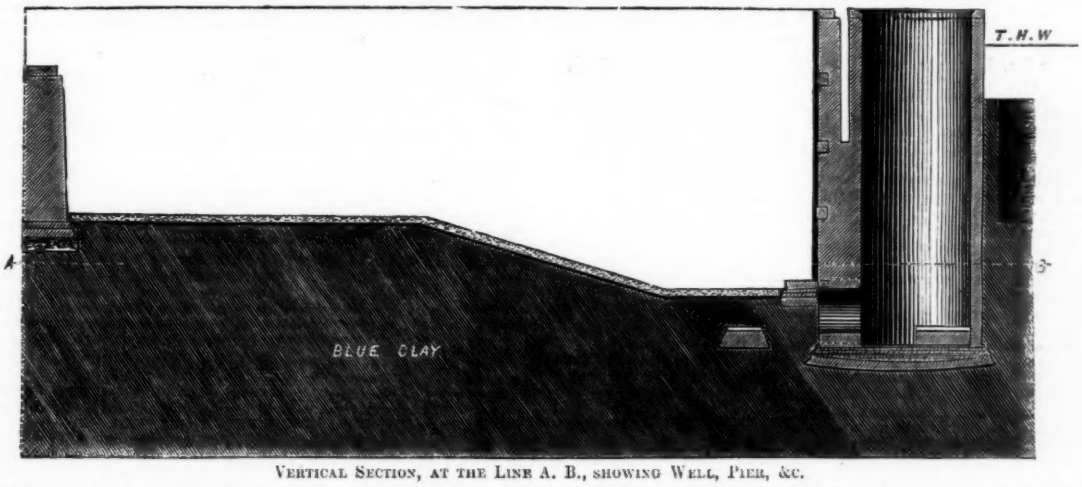
Hoop Iron.—Circles of hoop iron of No. 12 gauge, and 1½ inch broad, rivetted together, are to be laid in the walls entirely round the tank, every six courses from the bottom of the footings to the top of the wall.

Mortar.—The whole of the mortar for the several works to be of the best

Gasholder Tank at the Bromley Station of the Imperial Gas Company.



Plan.



Vertical Section, at the Line A. B., showing Well, Pier, &c.

fresh burnt blue lias lime and good sharp clean river sand, in the proportion of one of lime and two of sand.

Cement.—The whole of the cement shall be composed of one measure of the best Portland cement to one of sand, the latter to be washed perfectly clean. Each and every brick used for the whole of the cement work to be well soaked or dipped in water before being laid. No cement on any account to be used after it has set, or begun to set; in either case the contractor is to remove the cement from off the works.

Stone.—All the stone used throughout this contract shall be the best Greenmoor or hard Yorkshire stone, to be free from flakes, beds, rents or any defects.

Timber.—All the timber employed, either temporarily or permanently, must be approved of by the engineer.

Shoring.—During the progress of the excavation before mentioned, the contractor is to provide and fix a sufficient quantity of timber walings, shoring, &c., and to close plank the whole of the excavation, so as to prevent the earth from slipping or cracking, and retain it in its present solid state.

Concrete.—The whole of the concrete shall be composed of good gravel, or Thames ballast, free from loam, clay, or other foreign matter, with the proper proportion of large and small stones, and fresh-burned unslaked blue lias ground lime, to be well mixed in the proportion of five of gravel to one of lime.

Footings.—The footings of the tank wall shall be 2 feet in depth, except that part which joins the well, which shall be 8 feet deeper than the other parts of the foundation. The lower four courses of the footings shall be seven bricks in breadth; each of the next courses to be regularly reduced, so as to leave the top of the footings five bricks broad. The wall of tank, four bricks in breadth, is then to be commenced on the footings, and to be carried up to the height of 19 feet. The wall then to be reduced to three and a half bricks in breadth, and so carried up to the top of the tank.

Cement Rings.—In the formation of the walls of tanks, there shall be six rings of brickwork built in Portland cement, each ring to be eight courses all round the walls of tanks and piers, and to be continued through the piers to their full extent. The brickwork in all cases to be perfectly level before commencing any of the above-mentioned rings in cement. That part of tank wall adjoining well, for a width of 22 feet, to be carried up in cement from bottom of footings to top of tank.

Counterforts.—There shall be 56 piers, or counterforts, built up with and bonded with the walls of the tanks. Parts of these are shown in the plan. The footings of the 56 piers to be set out, four bricks in length, by nine and a half bricks wide, at right angles to the outside of the tank walls; to be then carried up four courses in height, when they will be reduced to nine bricks in width and three and a half bricks in length for two courses; then to be reduced to eight and a half bricks wide and three bricks in length for the other two courses. The piers then to be set out on the footings two and a half bricks in length and eight bricks wide, and carried up 11 feet 6 inches, then to be extended over the set-off in the back of the tank wall to three bricks, and carried up to the top of the tanks, making the thickness of the piers and walls of tanks, from the face of the tank wall to the back of the counterforts, 4 feet 10½ inches from the top of the foot of piers to the top of the tank wall. The piers, one on each side of the well, shall be built up entirely in cement.

Curbstones.—On the top, and entirely round the tank wall, shall be laid a stone curb, closely bedded in cement, the stones to be wrought fair on the top and inside edges, equal to the tooled facing, with radiating joints, and fitted to a true circle, corresponding with the inner circle of the tank.

Tank Curbstones.—There shall be 72 stones for the curb, each 7 feet long by 1 foot 9 inches wide and 12 inches thick, placed on the top of each tank. All the joints of the stones on the top of the tank walls to be connected in the centre with two lead plugs 1½ inch square, run into each stone 4½ inches.

Column Stones.—There shall be 28 stones for the bases of the columns in each tank, 6 feet by 4 feet 10 inches, and 1 foot 3 inches thick, each stone to be well bedded in cement on top of the column piers, each stone to be worked fair on the top and edges, and the front edge worked to a true circle, corresponding with

the inside of the tanks, and each and every stone to be set perfectly level with each other round the whole circumference of the tank.

There shall be four holes 3 inches in diameter jumped through each of the pier stones to receive the holding-down bolts for columns.

Well Stone Curb.—There shall be laid on the top of the walls of wells a stone curb 18 inches broad by 9 inches in thickness.

Brick Piers in Wells and Tanks.—There shall be brick piers built in Portland cement at the bottom of the tanks and wells for carrying the vertical pipes; the piers shall be built up from the bottom of well 3 feet high.

Rest Stones.—There shall be 56 rest stones bedded on the small piers in each tank. These stones to be 5 feet 6 inches long by 2 feet 6 inches wide, and 12 inches thick when worked, to be set perfectly level one with the other round the entire circumference of the tanks.

Centre Pier.—There shall be a brick pier built in the centre of the tank; the foundation of the pier shall be formed by excavating down into the blue clay a depth of 4 feet, the excavation to be 14 feet square. There shall be laid on this foundation a bed of concrete, 14 feet square and 2 feet thick. The footings shall then be set out in the concrete 13 feet square, and reduced in eight courses so as to leave the top of the footings 12 feet square. The pier is then to be set out 11 feet square, and carried to the height of 19 feet, where it will be diminished gradually to 10 feet square.

Permanent Well.—There shall be a permanent well built up and bonded into the tank walls. The well to be 14 feet diameter in the clear, and 46 feet 6 inches in depth to the bottom of the footings. The footings to be formed by an invert 23 feet 6 inches in diameter, and 18 inches thick. The invert then to be filled up solid and level, and the footings of well set out on the top of the invert 22 feet 7 inches in diameter, reducing in each of the next four courses, so as to leave the top of the footings 21 feet 1 inch in diameter. The walls of the wells shall then be set out 14 feet diameter in the clear, and 18 inches thick. The walls of the wells and tanks shall be carried up together in solid brickwork. An oval opening, 8 feet by 7 feet, to be formed in the walls of the wells and tanks for the inlet and outlet-pipes.

Walls of Wells.—The walls of the wells, from the footings to the top, to be cased externally with three courses of plain tiles, bedded in Portland cement, and the outer surface to be rendered over with one coat of cement, so as to make the well perfectly water-tight.

Centre Pier to Provide and Fix Stone.—To provide and fix a stone in the top of the centre of the pier 8 feet square and 15 inches thick.

Guide-Rod Stones.—There shall be 168 stones, each 2 feet 6 inches by 1 foot 6 inches by 1 foot 6 inches, built in on the inside of the walls of each tank—viz., three over each rest stone, for securing the guide-rods.

Concrete.—The whole of the bottom of the tanks and cones to be covered with well-prepared concrete, as described, and to be 12 inches in thickness.

Puddle.—At the back of the tank walls, piers, and wells, from the bottom of the footings to the top of the tank walls, shall be laid with well-prepared blue clay puddle, 2 feet in thickness, and to be laid down in regular layers of 6 inches each, and every layer shall be closely and firmly rammed. All the clay to be well tempered and worked by a pug-mill before being used. The driest of the earth shall be selected, filled in and well rammed at the back of all the clay puddle, and in layers of not more than 6 inches at any time.

Cast-Iron Plates and Bolts.—There shall be a cast-iron plate, with four holding-down bolts, built into each of the 28 column piers. The bolts and plates will be provided by the Imperial Gas Company, but must be fixed by the contractor.

(*To be continued.*)

DEATH OF MR. JABEZ CHURCH, C.E.—This melancholy event took place on Thursday last, at his residence, Hamlet House, Chelmsford. For nearly a year Mr. Church had been in failing health, and during the last six months had been wholly laid aside by an illness, the fatal termination of which soon became manifestly certain. Many of our readers will receive the above intelligence with little surprise, for the news of Mr. Church's illness had spread amongst his professional brethren, and much sympathy was expressed for him in his sufferings, as we know it will now be expressed for his bereaved family. Mr. Church was a man who could not fail to attract friends, his open, manly countenance, and the cheerful, happy temperament, which he preserved to the last, naturally drew them to him, and, once gained, he could not fail to retain them. As a civil engineer his ability was generally recognized, and secured for him a large and increasing practice in Parliament and throughout the kingdom. About 28 years ago, he became engineer of the gas-works at Chelmsford, and he continued to reside in that town, having professional chambers at Westminster. In 1854 he was elected an Associate of the Institution of Civil Engineers, and became a member of that body in 1870. In 1871 he was appointed to the office of President of the Society of Engineers, and in the same year was made President of the British Association of Gas Managers. He was also a Fellow of the Geological Society. On the death of the late Mr. Barlow, he became consulting engineer to the Dublin and Alliance Gas Company, and he was connected with many other gas and water undertakings. In the neighbourhood where he resided his loss will be keenly felt, as for many years he had taken a prominent part in local affairs. He was a member of the Local Board of Health, churchwarden of St. John's, Chelmsford, and had always shown a lively interest in the educational and philanthropic institutions of the town. He was in the prime of life, having only attained his 51st year.

PORTISHEAD DISTRICT WATER COMPANY.—A special meeting of shareholders was held on the 16th inst.—Mr. Weatherby in the chair—when a report from the directors was presented, which stated that the company's bill had passed the House of Commons, and through all the final and formal stages in the House of Lords, without opposition. The directors had entered into a contract with Messrs. Warren, Bull, and Minns for the supply of all necessary materials and construction of the whole of the works, including reservoirs, mains, and branches complete, and in perfect working order, for the sum of £20,246. The District Highway Board had granted permission to deal with the roads without waiting for the passing of the Act. Possession of the land was given to the contractors as soon as the purchase was completed. In view of the completion of the works in the course of the present summer, a decision became necessary upon an offer made for the first three years working of the undertaking by two members of the firm of contractors. This proposed arrangement comprised the payment by the contractors of all expenses of working and maintenance, and the payment to the company of a sum of £1200 for the first year, £1450 for the second year, and £1700 for the third year, dating from the full completion of the works; the contractors in return to receive all the revenues for such three years. Having regard to the advantages of obtaining a certain dividend during the time occupied in developing the business of the company, and of having that development assisted by the exertions of gentlemen of great experience in similar enterprises, the directors had determined to recommend the acceptance of this offer to the shareholders. The engineers, Messrs. Russ and Minns, stated in their report that the progress made in sinking the shaft, though slow, is perfectly satisfactory. A depth of 82 feet, out of 100 feet, has been reached, and water is already obtained in such quantities as to necessitate the employment of a steam-engine and large pump to keep it down. The copy of an analysis made by Mr. W. W. Stoddart of a sample of the water obtained from the works was annexed. It was to the effect that the water was of good quality and exceedingly pure. The report and recommendations of the directors were adopted.

Correspondence.

BUENOS AYRES GAS COMPANY.

SIR,—Mr. Wilde says that the company which he represents is the "real original;" so let it be. I desire to say that the Consumidores di Gas, which I represent, is the *new* company—the Buenos Ayres Gas Company, Limited.

It is quite true (as Mr. Wilde says) that there are four companies now supplying the city and suburbs with gas, three of whose works were designed and erected by me; and I write as emphatically as Mr. Louis Wilde can write, that not one of the three is in any way connected with the "real original" and venerable company he represents.

St. Neots, May 20, 1875. GEORGE BOWER.

PROPOSAL TO INVITE LADIES TO THE GAS MANAGERS EXCURSION.

SIR,—As a member of the British Association of Gas Managers, I have received the usual cards and programme relating to our meeting in Leeds. I fully expected that some intimation would have been given in regard to ladies joining us on the pleasure trip, but there is no such reference.

I think the secretary, Mr. Bennett, should give us some idea as to whether it will be possible for ladies to enjoy the out with their husbands or friends, especially as a general feeling was last year expressed that they should be invited in future.

I am certain I shall enjoy the trip the more if they accompany us to

STUDLEY ROYAL.

Parliamentary Intelligence.

HOUSE OF COMMONS.

THURSDAY, MAY 20, 1875.

The Lords amendments to the Pontypridd Water Bill were agreed to.

The Busby Water, Greenock Water (Lords), and Hamilton Water Bills were read the third time, and passed.

The Birmingham Gas (Nos. 1 and 2), Broadstairs Water (Nos. 1 and 2), Marlborough Gas, and Tunbridge Wells Gas Bills, as amended, were considered; to be read the third time.

METROPOLIS GAS COMPANIES BILL.—A petition against this bill was presented from the London Gaslight Company, and referred to the select committee.

FRIDAY, MAY 21.

The Lords amendments to the Ashton-in-Makerfield Local Board, Cleethorpes Gas, Hindley Local Board, Oxford (Corporation) Water, and Pemberton Local Board Bills were agreed to.

The Widnes Local Board Bill was read the third time, and passed.

METROPOLIS GAS COMPANIES BILL.

A petition against this bill was presented from the Commercial Gas Company, and referred to the select committee.

Sir CHARLES ADDERLEY gave notice that on Monday, May 24, he would move—"That Mr. William Edward Forster, Mr. J. G. Talbot, and Mr. Bristowe be members of the select committee on the Metropolis Gas Companies Bill."

HOUSE OF LORDS COMMITTEE.

MONDAY, MAY 3.

(*Before the* EARL OF MORLEY, *Chairman; Earl* FORTESCUE, *Lord* DUNSANY, *Lord* ASHBURTON, *and Lord* HANMER.)

COLCHESTER GAS BILL.

Mr. LITTLER, Q.C., and Mr. MICHAEL appeared for the company; Mr. RICHARDS, Q.C., and Mr. PHILBRICK, Q.C., for the Corporation of Colchester, petitioners against the bill.

Mr. MICHAEL opened the case with a statement of the past history of the company, and the necessity they were under for seeking further powers for raising capital, and for increasing the price of gas. He also read and commented upon the allegations in the petition, and asked the committee to follow the course adopted by the other House, and pass the preamble of the bill.

Mr. *Harvey*, chairman of the company, recapitulated the evidence given by him before the Commons committee as to the position of the company, and their need of fresh capital. They had raised £32,000 in shares, and £5000 on loan, and though the directors were empowered by the shareholders in 1867 to raise a further sum of £5000 out of the remaining authorized £8000 of capital, by the creation of new shares, they only raised £2000. They considered that it would be useless to make the attempt, as the condition of the company was not sufficiently attractive to invite capitalists to take shares. They had been obliged to expend money out of revenue on capital account; from 1861 to the present time they had so applied £1500. He considered it absolutely essential to the profitable carrying on of the undertaking that they should have the power to charge an increased price for gas; and what induced the shareholders to ask for the assistance of Parliament in that respect arose from the disappointment they experienced last year, and the desire to protect themselves against a similar disaster, in case of coal famine in the future. They did not intend to charge the maximum price merely for the purpose of getting the maximum dividend. They had never yet earned the maximum.

Cross-examined by Mr. RICHARDS: We are under obligations as to testing the illuminating power of our gas. We have had no complaint from the lighting authority ever since December, 1871. We are quite prepared to show that we have kept gas even beyond the parliamentary standard, and there are few complaints of the private consumers.

Mr. RICHARDS: Do you not think it rather soon to come to Parliament, when, in fact, you have not raised 13-25ths of the capital that was authorized in 1866?

Witness: It would appear so if we had come to Parliament entirely for power to raise capital; but, being obliged to come to Parliament for power to raise the maximum price of gas to protect the company from loss, we considered it a favourable opportunity to ask for power also to increase our capital, knowing that we must have an immediate and a large expenditure upon the works. We were advised that we had better do so, as the luxury of coming to Parliament is rather expensive. Had it not been for the necessity of obtaining an increase of price, we should not have come to Parliament at this period, when 13-25ths of our present authorized capital has not been called up. We have thought it better, in past times, not to increase the capital of the company. We wished to keep the price of gas as low as possible; we did not want to come to Parliament to ask for extra power, and we should not have done so if it had not been that the price of coal has placed us at a great disadvantage and loss.

Mr. RICHARDS: If you get the additional price you now ask for, you will be enabled, will you not, under the Gas Works Clauses Act of 1847, to pay up for back years all your full dividends?

Witness: We probably might be able, but we have never contemplated it. I should like to repeat that the reason why we come to Parliament is not to ask Parliament to give us the extra 9d. to pay back dividends, but to enable us

to meet an emergency that may arise similar to the one which we had to contend with in 1873.

Mr. RICHARDS: In 1866, when you came to Parliament for your Act, you had negotiations with the Colchester Commissioners, whom the corporation now represent. Was not the result of those negotiations that another bill was actually prepared and deposited by the commissioners, to give them power to supply the town with gas?

Witness: No, not the commissioners. There was a bill deposited by a body of people calling themselves gas consumers, and it was styled the Gas Consumers Company. As soon as notice was given in the newspapers that that bill was to be brought before Parliament, we thought it our duty to seek incorporation ourselves, and we gave notice accordingly.

Mr. RICHARDS: Was not the result of the negotiations, or whatever you please to call them, that you undertook to supply the Corporation of Colchester for their public lamps at a price equal to one-eighth less, or a discount of 12½ per cent., as against the price charged to the private consumers?

Witness: That is a part, but not the whole truth, and it is calculated to make a wrong impression. The promoters of the Gas Consumers Bill found that they got very little public support, and they made some overtures to us. Two of us waited upon the promoters of that bill, and it was then agreed that they should withdraw their bill, and that we should insert a clause in our bill stating that the maximum price of gas should be 5s., and, if the rise of material justified it, 5s. 6d.; and they pledged themselves then to give their support to the passing of our bill through Parliament. After we had arrived at that conclusion the commissioners took the matter in hand. The pressure they put upon us was rather great, and as we were anxious to get the bill through Parliament, we agreed then to supply the public lamps at one-eighth less than the price charged to private consumers, the maximum for which was to be 4s. 3d. per 1000 cubic feet. I want to show that the Gas Consumers Company at that time, coals costing us into the yard 13s. 6d., agreed to support a maximum of 5s. and 5s. 6d.

Mr. RICHARDS: Do you think it fair that before the capital raised by the powers of that Act is exhausted, you should come and seek to abrogate the contract and agreement partly in virtue of which you obtained that very bill?

Witness: We feel that we are lighting the public lamps at a loss, and we think that we are justified in remedying that evil.

Mr. RICHARDS: But you admit that you are coming to abrogate a contract which you deliberately made in 1866?

Witness: A contract which is unprofitable to us.

Mr. RICHARDS: What would you say to the corporation if they, finding the bargain unprofitable, had come and sought to abrogate the contract?

Witness: That is a somewhat inconceivable position.

By the COMMITTEE: I have no doubt we shall make a small profit this year. The falling off in the profit during the last two years is attributable entirely to the high price of coal and other material, and the advance in wages.

Mr. *Browning*, the company's manager, gave evidence as to the necessity for enlargement of the works, &c. He stated that the charge made by the company for gas to the public lamps was one-eighth less than to the private consumers.

Mr. *R. P. Spice* said he had examined the company's works, and made a careful survey of the district supplied. The amount of capital actually expended by them was £37,563, and he estimated that £7000 was required to put the works in proper working order. The result of that outlay would be that the company could make gas more economically.

Mr. MICHAEL: From a consideration of the position of the company, have you arrived at an opinion as to the price which ought to be charged for gas?

Witness: I think the price allowed by the committee of the House of Commons is a very fair settlement of that question.

Mr. MICHAEL: Of course, if the price of coal decreased, and wages and other matters, the company would be able to charge a less than the maximum?

Witness: Yes, and every company would wish to charge as low a price as possible for the gas. It is well understood that the lower the price the healthier and more satisfactory the business, within proper limits.

Mr. MICHAEL: Have you looked at the circumstances at the time the Act was passed in 1866?

Witness: Yes, and my opinion is that the company were badly advised in assenting to those terms. They should never have been left without any margin whatever for such contingencies. The company ought to have, considering the extent of its business, a fair working capital of £4000. £4000 ought to be the amount of their capital in addition to the capital that they have expended in works, and then they might carry on their business in a proper and regular way, and when the time comes they would set aside a portion for a reserve-fund—a luxury which they know nothing about.

Examination continued: The cost of coal last year per 1000 cubic feet of gas sold, was 43·35d.; of which, 13·79d. was recouped by the sale of residuals, leaving the net cost of the coal 29·56d. The working expenses were 19·36d. The total cost per 1000 feet of gas was, therefore, 48·92d., without allowing anything for dividend on capital. The amount per 1000 requisite for dividend is 1s. 6d. which makes a total of 66·92d., which is 5s. 7d. So that in point of fact 5s. 7d. would require to be charged with coal at the price it was in 1874, in order to pay the dividend.

Cross-examined by Mr. RICHARDS: I suppose that, looking at Colchester generally, and looking at the camp and all the circumstances, the increase in the consumption of gas might average about 8 per cent. or 9 per cent. per annum. I should say that Colchester will increase a little below the normal rate, which is 10 per cent.

Mr. RICHARDS: Have you any reason to suppose that Colchester will increase during the next few years more rapidly than it has increased lately?

Witness: I should think so.

Mr. RICHARDS: Tons of coal carbonized in the last few years—5555 in 1874, 5853 in 1873, 5751 in 1872, 5273 in 1871, 5596 in 1870—that does not look much like an increase in Colchester, does it?

Witness: I have known a large increase in the make of gas without any increase in the consumption of coals. Improved working will account for that in many cases.

Mr. RICHARDS: I suppose that means the present working is very bad?

Witness: I have known as much as 40 per cent. added to the return from a given quantity of coals, and I have no doubt that under the management of Mr. Browning they will get up to 10,000 feet of gas per ton of coal, which would give them a very largely improved profit.

Mr. RICHARDS: And they would get that without any additional capital?

Witness: Yes; and that would enable them to keep the price down below the maximum 5s., but they cannot raise capital unless they have that authority.

Mr. *G. W. Stevenson* said he had examined into the present working of the company, which was more favourable than it was in 1867, the first year after they got their Act. Their capital in 1867 was 17s. 10d. for every 1000 feet of gas sold; now it was 16s. 8d. Their wages were then 7·86d. for every 1000 feet of gas sold, and now they were 5·90d. The repairs and maintenance in 1867 were 7·92, and now the cost of repairs and maintenance was 4·73d. Then directors and auditors worked out less, salaries worked out less, and the total working expenses, comparing 1874 with 1867, were 19·36d. as against 25·50d. During the last year they got a larger volume of gas from a ton of coal than they did in the year before; in fact, they had been able to sell considerably more gas while carbonizing less coal. The working of the company compared very favourably with the working of other companies in every respect, except that they were at a disadvantage with regard to the production of gas, because their retorts were down in a hole—below the tidal level—and a large proportion of the heat from the coke, which ought to go to carbonizing the coal, went in evaporating the moisture in the beds of the retorts.

The COMMITTEE: Can you say what the charge for directors is?

Mr. RICHARDS: We raise no objection upon that; it is very small.

Witness: The directors and auditors have been paid £221 each for the last five years, and that works out at 1½d. per 1000.

Mr. RICHARDS addressed the committee in opposition to the bill, contending that there was no reason, even according to the company's own showing, for any increase upon the present maximum price of gas.

Evidence having been given as to the price of coal,

Mr. *A. Penny*, examined by Mr. PHILBRICK, said he had been over the company's works. The company had £8000 of share and £5000 of loan capital still uncalled up, and that sum was amply sufficient to provide for what he might venture to call the exaggerated statements as to the wants of the company. There was no necessity for their coming at this moment for it, because they had power to raise in shares and borrowing capital £13,000. He had gone very carefully over the accounts of the company as furnished to the clerk of the peace. He took the year 1874, and made such calculations as convinced him that there was no necessity for them to come to Parliament to ask for an increase of price. Taking 19s. as the price of coals, and giving them the benefit of every figure in their accounts, it would produce an amount of profit which would give them 7 per cent. upon all their capital. The question of the price of gas in future should be based upon a normal condition of the price of coals, and not upon an abnormal one. The whole question of the want of profit in 1874 arose from the abnormal price of coals.

The CHAIRMAN: All these questions about the prices of coal and the prices of gas, and the rest of it, must have been gone into in the House of Commons.

Mr. LITTLER said that there was a most careful inquiry in the committee of the House of Commons.

Mr. PHILBRICK stated that before the committee of the House of Commons no evidence was called on behalf of the petitioners.

By the COMMITTEE: There was no doubt that the working of the company could be improved; but, for the purpose of his argument, he took the existing state of things, and even then, with coals at 19s., they could produce a profit of £2896.

Cross-examined by Mr. LITTLER: He would not like to go so far as to make a contract to do so for ten years to come with the present price of coal.

Mr. LITTLER: We do not like to come to Parliament more than about every 15 years; that is about the right time, is it not?

Witness: I do not think a company should be compelled to come too often. Very few companies remain away from Parliament more than 15 years.

Mr. LITTLER: All these expensive contests fall upon the consumers, and in this instance upon the unhappy ratepayers, too, who do not like it; but you think, at all events, that we should not come in less than 10 years?

Witness: I think that if this company had thought so, they would not have come till next year. I do not think that a company ought to come to Parliament while they have a large capital unexpended.

Mr. LITTLER: Why should we not have the power of selling the gas at such a price that we may get our maximum dividend as limited by Parliament?

Witness: The company have been satisfied with less dividends up to this time.

Mr. LITTLER: And because we have been satisfied with less dividends up to this time, we are to continue to do so; is that your argument?

Witness: My argument was that a certain agreement was made years ago, which the company were satisfied to make, though that was an agreement which did not enable them to pay their maximum dividend at that time.

Mr. LITTLER: As that agreement was made which did not enable them to pay their maximum dividend, you think that they should be bound by it in all time, notwithstanding the increase in the price of coal, which nobody thought of, and notwithstanding their having no dividend for last year, which nobody thought of; is that your view?

Witness: It is not my view, because I say that they could have paid their dividend before, if they had chosen to do so. If coals go up to the abnormal price which existed last year, I admit at once that they cannot make their dividend, but I say then that there are means of reducing their expenditure so as to get more profits out of this very working.

Mr. *H. E. Jones*, C.E., gave corroborative evidence.

Mr. *A. L. Laing*, an alderman of Colchester, deposed to the feelings in the Town Council against the bill.

Mr. *Hope*, surveyor, was called to speak to the cost of public lighting, &c., but the CHAIRMAN intimated that this question did not affect the preamble of the bill.

Mr. *Paxman*, member of a firm of engineers in Colchester, gave evidence in opposition to the proposed increase of price.

The committee, without calling for a reply, unanimously passed the preamble of the bill, and the clauses as settled in the House of Commons were agreed to.

HOUSE OF COMMONS COMMITTEE.

TUESDAY, APRIL 27.

(*Before Major* ALLEN, *Chairman*; *Viscount* HOLMESDALE, *Mr.* W. H. FOSTER *and Mr.* CARPENTER GARNIER.)

NEWPORT (MONMOUTHSHIRE) GAS BILL.

Sir EDMUND BECKETT, Q.C., Mr. GRANVILLE SOMERSET, Q.C., and Mr. MICHAEL appeared for the promoters; Mr. BIDDER, Q.C., and Mr. JEUNE for the Alexandra Dock Company, who opposed this bill.

The promoters seek parliamentary powers to erect auxiliary gas-works on lands adjoining the Alexandra Dock, and the dock company oppose, on the ground that they *bonâ fide* require the land for sidings and for marshalling their goods, and that they were in treaty with Lord Tredegar for the purchase of the property.

Sir E. BECKETT having opened the case, the following witnesses were called.

Mr. *Thomas Gratrex*, examined by Mr. MICHAEL.

I am chairman of the Newport Gas Company. We have expended upon works now constructing a sum that will absorb all our new share capital, amounting to £50,000. It is essential for the purposes of the company that we should have the means of acquiring the reversion in fee of the leasehold portion of the premises which we now occupy. We are constructing a very large tank and gasholder on the freehold portion of the land, at a cost of £7500. It is on the lowest portion of the district that we propose to construct the new gas-works. The company are advised by their engineers that it is impossible to meet the constantly increasing demand for gas upon the present site. We are daily increasing the supply to meet the demand.

Cross-examined by Mr. BIDDER: There is a considerable tract of marsh land, about half a mile distant, belonging to the corporation.

Mr. MICHAEL objected to this line of examination, on the ground that the petition of the Alexandra Dock Company did not contain any statement with reference to an alternative scheme.

The CHAIRMAN said the committee were of opinion that the cross-examination should not go beyond that point.

Cross-examination continued: I do not know, of my own knowledge, that the corporation land is in the market, or that it has been offered for sale to the gas company. I have been for many years interested in the Monmouthshire Railway. I have not heard of any objection from them to our interfering with the curve or spur line which is to be made, to connect them with the dock

line. I am not aware that the railway company attach any importance to their being connected or not with the Alexandra Docks. I should think there will be a very large coal business done at the docks, and this will require rather a large area for siding, particularly in the neighbourhood of the junction. There will also be a great demand for siding accommodation, both for loaded trucks and empties at the point where the railway company hand over the traffic to the dock company. I think the site that we have fixed upon is the most convenient site. I do not think it will interfere with the traffic of the dock company. We have not consulted the dock company as to whether it would be convenient to erect the gas-works on the proposed site. We did not know till lately that the lands required belonged to the company.

Re-examined by Mr. MICHAEL: It was upon the advice of Mr. Hawksley, the engineer to the gas company, that we asked for powers to obtain the lands. The directors of the gas company have had constant verbal communication with the dock company.

Mr. *E. J. Phillips*, deputy-chairman of the Newport Gas Company, gave evidence in support of the statements of last witness.

Cross-examined by Mr. BIDDER: I do not think it will be necessary for the dock company to possess any of the land required by the gas company for marshalling their trains and goods. With the two bridges there, the engineer could not possibly contemplate marshalling trains at that spot. The gas company's mains run right through the town down to the docks.

Re-examined by Mr. SOMERSET: We supply about 1¼ million feet of gas every year to the dock company. To meet the demand of the town, it is absolutely necessary that the company have additional works, and the only spot on which we can build them is this land adjoining the docks. The Monmouthshire Company have been in treaty with Lord Tredegar for the purchase of a piece of land for the sidings of their traffic and that of the dock company—at least, I have heard so. I do not know that the land proposed to be taken by the gas company belongs to the dock company. I do not see how our new works can interfere with them.

WEDNESDAY, APRIL 28.

Mr. *Thomas Canning*, examined by Mr. MICHAEL.

I have been engineer for the promoters since March, 1874. I was a pupil to Mr. Fiddes, of Bristol, and afterwards was manager of the Stroud Gas-Works. The area of the land upon which the Newport Gas-Works are constructed is 1 acre 3 roods 12 perches. It is situated quite at the extremity of the borough, and is totally insufficient to meet the increasing demand for the supply of gas. Our maximum make is 400,000 cubic feet per day, at the very outside. We have now a demand for that amount, and there is a very great likelihood of its being increased, because, in the first place, we have to enlarge the greater part of all our present mains, and, besides, we are lighting up places to which no gas has hitherto been carried. We have already laid mains, and shall be called upon to supply a large quantity of gas, to the Alexandra Dock. We have erected at the dock 48 pillar and 24 bracket lamps, making a total of 72 lamps, besides other lights. I do not know what arrangements they have made, but it is more than probable that the lamps will each burn far more than 5 cubic feet per hour. [Witness here handed in a diagram which he had prepared, showing the present working, the prospective wants, and the proposed increased supply.] Our present site is quite overworked, and it is absolutely necessary for us to have an additional one; otherwise, in two years, at the very utmost, we shall be obliged to leave a large portion of the town in darkness. I consider that the proposed site is an admirable one for the erection of works, and decidedly competent to supply gas at a cheap rate. It is the very best place for supplying the prospective wants of the town, which is increasing very largely in the south-west quarter.

Cross-examined by Mr. JEUNE: We supplied over 400,000 cubic feet per day during last winter, but are not capable of supplying as much as that at present. Fifteen of the retorts which we then used are completely worn out, and we have not space upon which to erect fresh ones to take their places. Per acre of site, 200,000 feet is the outside we can make, and that amount is not practically done at the generality of works. At our present works we are employing all appliances which can be used for supplying as much gas as possible upon a limited space. We have a telescopic holder in operation, and are erecting another. When this second holder is finished it will not increase the amount of gas which we are able to supply, because we shall have to extend our producing power first, and, as I have stated before, we have no space whatever upon which to erect the smallest fraction of additional producing power. The amount of coal we expect to consume on the new site depends altogether on the increase that may go on in the town from year to year. Our present requirements are 10,000 tons annually, and about the eighth of a ton is required for 1000 cubic feet of gas. I should recommend five or six acres to be taken for the new site, as I think it will, in future, be far better to have all extensions of the works together. There is no doubt the time will come when the whole of that five or six acres will be utilized. Coming to the question of the supply of coal for the new works, I hope to get it along the railway which is being constructed, and is quite convenient to our works. We have every expectation of having a siding, as we have to our present works, although we have no parliamentary powers. It is the usual state of things for a gas company, adjacent to a railway, to get their coal by rail. If there is no siding we could haul our coal to the works at a very little cost. I do not think it would cost more than 1s. or 1s. 6d. a ton, which is practically very little. I carefully considered this site at the time the plans were deposited, but did not know that part of the land we propose to take is within the limits of deviation of a railway which the dock company are authorized to make, and that part of it also is within the limits of deviation of a road which the dock company are obliged by Parliament to make.

Re-examined by Mr. MICHAEL: If the road were made, I should recommend the promoters to do away with that portion of the land, because it would be perfectly useless to us. Four acres would then remain, and this will be available for future supply for some considerable period. Our practical difficulty is not storing, but manufacturing gas. We have to supply a larger amount of gas than we can make. Therefore it is in the interests of Newport that we should have increased means of manufacturing gas—the public will suffer, but I do not think any people will suffer more than the opponents of the bill. Compulsory power will not be sought to make the siding to take coal into our yard, as all railway companies, as far as I have had anything to do with them, are always glad to give necessary sidings. If the Newport Railway, to the westward, should fail us, we have the Monmouthshire Railway quite close, so there will not be the slightest difficulty in landing coal close to the site. When we have the new works we shall be able to manufacture gas more economically and supply it more cheaply, because to supply it from our present works means extra mains, extra pressure, extra leakage, and extra price to the whole of the bottom of the town. Any increased space we get will enable us to manufacture and supply gas at a cheaper rate.

By the COMMITTEE: Even if we could manufacture the amount of gas we want from our present works, it would be at an extra cost. The public will reap the benefit of our going to a nearer site, in the reduction of price. I never knew a case of a railway company refusing to bring coal to a work, wherever it was possible for them to do so.

Mr. *John Warren*, examined by Mr. MICHAEL.

I am a civil engineer and surveyor, and prepared the deposited plans and sections. I laid down on the plans the No. 6 line of the dock company's railway, which we shall not interfere with, by taking the lands proposed in the bill. The promoters are willing to give up any portion of the site within the limits of deviation as appearing on the railway company's plans. So long as they have any power to construct, we shall not encroach upon the proposed extension railway in any way whatever. We shall then have about four acres, without in any way interfering with the railway or with the road, as the parliamentary plan shows they are going to construct it. I consider the four acres would be adequate for the purpose of the gas-works, being more than twice the quantity occupied at the present time. There would be no difficulty at all in getting coal. It could be sent by rail, and only have to be hauled a short distance.

Cross-examined by Mr. JEUNE: When I laid out the deposited plans I did not think that the spot was the focus where the branch lines of railway centre before separating out again upon either side of the docks. I do not think it will be so very inconvenient a position for the dock company to give up for the purpose of the gas-works. If No. 6 branch is made it will be necessary to have a large number of sidings, but these can be made without touching this land. With the consent of Lord Tredegar, the owner of the land, the line of rails could be extended beyond the limits of deviation. The parliamentary plans show these limits, and we come on one side for the purpose of making the works. The dock company have power to go to that side, but it would be inconvenient for them to do so, whereas the land is very convenient for us. I do not think there is power to get a siding from the Monmouthshire Railway, but we could have the coal delivered at a point close to the proposed site, and haul it along the public road in carts. I laid out the plans from instructions received from the gas company, and did not know they were taking more land than was necessary for their purposes.

Re-examined by Mr. MICHAEL: I think it is about 10 years since the dock company, by their Act, obtained power to construct this No. 6 branch line. There is no reason why this line should not be constructed so as not to interfere with the land we require.

Mr. BIDDER, in reply to the Chairman, said the petitioners were not at all inclined to accept the proposed restrictions of the land required by the promoters.

Mr. *Walter Fiddes*, examined by Mr. MICHAEL.

I am a gas engineer, of considerable experience, at Bristol. I know the present site occupied by the Newport Gas-Works, and, in my opinion, it is not, nor could it be made, adequate for the requirements of the company. It is desirable that the company should go to some other site to erect works. I know the proposed site, and think it a suitable one, where gas could be manufactured economically for the supply of the borough. Four acres is an area which is about equal to a supply of 700,000 or 800,000 cubic feet per day. The present maximum supply of 400,000 feet could be made upon two acres, so that the old works and the four acres of fresh ground would be sufficient for a supply for about 10 or 12 years to come.

Cross-examined by Mr. BIDDER: The gas company, with their present site of not quite two acres, cannot work economically so as to turn out 400,000 cubic feet per day. There is not sufficient area for the works to be made adequate for the supply. There is a new holder being erected, and this will bring up the storeage power equivalent to the present producing power. For want of proper gasholder accommodation the company have not been able to develope their works to their full capacity. This new holder will enable them to do so to a limited extent only, as they propose to take down some of their present holders, which are very small indeed, and nearly worn out. Their storeage power will in the end be nearly doubled, and this will, to a great extent, meet the wants of the town. They are not working with any degree of safety at present—they incur the risk of running out of gas. There is not land for the present site to be added to. I have been shown some land belonging to a Mr. Cordes, but the owner objected to parting with it, and, besides, there would have been great difficulty in erecting works on that place—it is on the side of a steep hill. The difficulty would have been in excavating the earth and building retaining walls. I did not go into the question of the extra cost, as they said the site could not be obtained. It was on my recommendation that they asked for six acres, as I thought they would require that amount in course of time. When they get cramped again they must get more land—on the same site, if possible; if not, on a third site. It would not be economical for them to get additional land on their present site—the levels will not admit of it. The docks can be supplied much better from the proposed site. The reason I think it desirable to have a separate establishment is that the mains are so small, and the gas can be much better supplied from the centre. The Chartered Gas Company's Beckton works are nine miles out of London. I do not know if they propose to bring the bulk of their gas that distance.

Re-examined by Mr. MICHAEL: It should not be supposed the circumstances of the supply from Beckton to London are exactly the same as the supply of Newport. The storing power at Newport is very deficient, the new holder will, however, make the storeage power sufficient for the supply, but it will not help the producing power at all. The four acres proposed to be taken will allow them to meet the increasing demands for the next 10 to 12 years. The supply will probably double itself in about 12 years.

By the COMMITTEE: The extra gasholder which is being put up will be a benefit to the town. The company cannot now, with any degree of safety, supply their customers—the holders will not contain sufficient gas, and are nearly empty by ten o'clock at night. If they could get, on the site of the old works, land enough to construct sufficient producing power, it would be cheaper than having the new works. The question, then, would be one of outlay for mains—they would have to double their capacity.

By Mr. BIDDER: Assuming the gas company to take the land outside the railway limits of deviation, it does not seem possible for the road to be constructed within the parliamentary limits; it appears to cut the railway off from the public road.

Mr. *Thomas Hawksley*, examined by Mr. MICHAEL.

I have, as an engineer, had large experience in the construction and management of gas-works all over the country. I have examined the existing works of the Newport Gas Company. They have gone beyond the power which they can use for the manufacture of gas. It is absolutely necessary, if the town is to be properly supplied, that the company should have a larger area of land upon which to make an increased quantity of gas. A fair make for works of this description is 200,000 feet per acre. The quantity ranges from only 150,000 feet in small works to about 250,000 in larger works. I have upon several occasions acted as consulting engineer of this company, and advised them when they obtained their Act in 1855. I have arrived at the conclusion that it would be extremely desirable to have additional works at the opposite end of the town. It is quite a mistake in gas-works to suppose it is beneficial to consolidate the whole of the undertaking. It is advantageous for management—there is a little more facility, no doubt, in managing the operations—but, in every other respect, it is detrimental, inasmuch as it requires very much larger mains than if the gas be brought in at opposite ends of a town. If gas is to be taken a short distance to supply a place, a certain sized main would be required; but if you want to supply a place occupying double the area, and say twice the distance, you must begin with a pipe of increased size, and the consequence is that the average size is very much larger than it would be if you had two pipes of the small size coming from opposite ends of the town. Besides, there is a more equal distribution, both of quantity and of pressure, when the gas is delivered in this way. The consequence is that now, in most of the large towns, two, three, four, and in one case within my knowledge five gas-works have been made. I therefore advised the gas company to obtain the proposed site for the further extension of their works. And there is another reason; there is no land near the existing site which is available for them, except a piece of highly inclined land, and this can only be obtained by compulsion. The 300 yards radius, under the Standing Orders, would require notices to be

given to hundreds of different people, because the land is in a somewhat dense part of the town; so that, independently of the ground being thus highly inclined, and not very advantageous in that respect, there would be opposition from the lessors and from the neighbourhood. The proposed site is advantageously situated with respect to level, and also to the non-residence of persons in its immediate vicinity. There is only one house or manufactory near, and being where the docks are likely to be placed, all the large manufacturing operations will very likely be carried on there. The quantity of land originally asked for was about six acres, but it is now limited to about four. This would not be competent to supply 800,000 feet per day, because, owing to the ugly configuration of the ground which is left, it would not be easy to construct apparatus in the same advantageous way as if the ground were square. The present daily demand for gas is, I think, about 450,000 feet, and the supply usually doubles, under ordinary circumstances, in nine years. This town is increasing at more than the ordinary rate, and even in less than nine years works equal to the present would be required, so in about 14 years the whole of the new land would be occupied. Supposing the road made as proposed by the dock company, I would recommend it should be used in common with the gas company, and the small portion of land cut off should be added to the gas-works, for placing holders upon, or for storing coal, or for any purpose not connected with manufacture. I most certainly believe these new works would be for the benefit of the gas consumers of Newport.

Cross-examined by Mr. BIDDER: When at Newport, I crossed the railway, and examined the land on the other side, to see what were the feasibilities of making an exchange, supposing one should be offered. It is more elevated, and would not be at all better than the proposed site. I thought, as this site was objected to, some proposal for a change might be made, and with that view examined several places. There is a good deal of marsh land, with very bad foundations. I found one other site which would be fairly suitable, provided every person entitled to notice would come in. An exchange could not be made under this bill, in consequence of Standing Orders rendering it necessary those notices should be given, unless with the free consent of all the parties interested. Of course, a clause might be inserted that, provided all necessary persons consented within the 300 yards, this land should be used in place of the other. There is any amount of acreage, but the field I saw was, perhaps, five or six acres. The site proposed in the bill was originally about six acres, including access, which, not being available for manufacture, must be left out in every case. That would have left about five acres, part to be occupied by effecting a communication, at a high level, with the railway, the remaining 4½ acres being for manufacture. I think that is little enough, as they are making new works. I should have recommended an area rather larger, taking into account the cost of the land, the possibility of not getting Lord Tredegar to dispose of a further portion, and the effect on the dividends and price of gas. As they are so used up in their existing works, they must be content with the two acres if they cannot get four. They would be able to double the existing supply on two acres. [Witness was here shown, by means of plans, that the promoters had consented to limit the site to ground outside the limits of deviation of the road—about two acres.]

Mr. BIDDER: How much would have to be taken off that reduced site for providing a siding for the coals?

Witness: I think the railway company would be very willing to give them a siding. Whether or not is a matter of agreement, but sidings usually are made on railway companies land. A coal siding would probably save 9d. a ton in cartage, which means a penny per 1000 feet, which either the public would have to pay or the gas company lose. If they construct on the two acres, they would build on arches, and use them for storehouses. It would, no doubt, be very expensive to build thus, but they could not do it with earth-work, as they would have to save space. Probably, after the siding is made, there will be 1¾ acre left for general manufacturing purposes. If the building were erected as proposed, no storehouses would be wanted for coals.

Mr. *John Warren*, recalled.

The CHAIRMAN: What amount of acreage would be left, if the promoters give up all the land within the limits of deviation of the railway?

Witness: The original quantity was between 5 and 6 acres. We omit a certain quantity, considering the road will be constructed as shown on the parliamentary plan. That will lessen the quantity by 1½ acre, leaving about four for our works. What the petitioner's counsel says is that if the road runs across the land, the 1¾ acre only will be left.

By Mr. BIDDER: We do not now propose to take compulsorily any land within the limits of No. 6 railway, but to take that which is within the limits of deviation of railway No. 1, which is already constructed. This would prevent the railway company continuing by sidings parallel to No. 1 line, any sidings that are laid down within the limits of deviation of No. 6 railway, but I should think, seeing the line has been constructed, the powers of purchase have expired. I have seen plans, at the Alexandra Dock, for buildings actually on this land, and it has been pointed out to me, by the engineer, as for building.

By Mr. SOMERSET: I think there is an improbability of the dock company acquiring this land, as they have miles and miles of sidings at the docks. There are no extraordinary circumstances in this case which would allow them so to acquire it, and they certainly do not require it.

This concluded the case on behalf of the promoters.

Mr. BIDDER then addressed the committee on behalf of the petitioners, and the following witnesses were called in support of their case.

Mr. *James Abernethy*, examined by Mr. JEUNE.

I am engineer-in-chief of the Alexandra Docks Company, and have been so since they obtained their Act in 1865. This Act provides for the diversion and alteration of the Mendelgyf Road, about which a good deal has been said by previous witnesses. At present there is only one access to the Alexandra Docks from the town, and that of a most inconvenient nature, inasmuch as it is crossed at various points by railways upon the level. At the time of the passing of the Act it was considered very important that, in addition to the railways, a line of road should be projected to communicate directly between the town and the docks, and this was to be accomplished by an extension of the then existing road to the entrance to the docks. We are bound to construct the road 60 feet wide, and metal it. By a slight deviation it will pass under the railway at right angles. The bridge, with a 35-feet span, is already constructed. The railway No. 6 was also authorized by our Act of 1865. [Witness here indicated on the plan the various lines authorized by this Act.] That line is necessary for getting the Eastern Valleys Railway traffic upon the Monmouthshire Railway. If communication of this sort is not made, shunting of a very inconvenient and dangerous kind would have to be continued. The Monmouthshire Railway Company are now pressing us to make the No. 6 branch, for the purpose of avoiding this inconvenience.

By the REFEREE: The bridge referred to as the one under which the Mendelgyf Road passes, is constructed for four lines of rail, but only two are laid, upon the side opposite the gas-works proposed site. The others will be placed there almost immediately. Beyond that we shall want a large amount of siding accommodation.

Examination continued: It will be necessary for the dock company to have the means of making sidings over the area the gas company propose to take. The docks have cost about £500,000, and we have already made provision for shipping two million tons of coal per annum. An agreement was entered into with Lord Tredegar with a view to taking certain land which might be wanted for the purpose of working, constructing, and maintaining, &c., the docks and quays connected therewith. There are about 200 acres in all, and, I believe, before the docks have been opened a year, we shall require all that land. Having regard to the future, it would be most prejudicial to the dock company if any portion of the land (included in the limits of deviation of any of the rails leading to the docks, and which we have power to take from Lord Tredegar, as traffic may demand) should be taken away. Because, although the present dock has only 29 acres of water, it is contemplated to extend it to the very mouth of the river.

Cross-examined by Mr. SOMERSET: We have 413 acres altogether in command from Lord Tredegar, and we could well spare four acres out of that for the gas company, but we object to the position of the particular four they have chosen. It would interfere most materially with the future accommodation necessary in connexion with the docks. Although we obtained powers in 1865 for that road, up to a very recent date there have been discussions as to how it should be carried—whether straight or curved. I personally decided the exact line of the road, within the last four or five months, by building the bridge. The dock company did not consult me respecting this bill until last month, and I then pointed out what course I intended the road to take. The Monmouthshire Railway formerly objected to No. 6 branch joining with them, as formerly proposed, and I do not know whether they have yet withdrawn their objection.

Re-examined by Mr. BIDDER: The limits of deviation will admit of the junction being formed at some other points than the one proposed, and this will shortly be arranged, as the railway company are desirous of having it done. I am perfectly satisfied we shall want all the land within the limits of deviation, and shall advise my company to acquire it if they can; it would be most decidedly required for the docks and sidings.

By the COMMITTEE: I should not advise any of the land to be given up except for the railways in the neighbourhood of the docks. No doubt plenty other could be found, as pointed out by Mr. Hawksley.

Mr. *Richard Glascodine*, examined by Mr. BIDDER.

I have been secretary for 30 years, and general manager for 24 years, of the Llanelly Railway and Dock Company. My whole time has been employed in the management of coal traffic on rail and at docks. I consider the Newport Dock Company will want a great deal of land just at the point where the lines from the north will concentrate, before they separate to the several staiths upon the south. Between these points it will be necessary to make great additional siding accommodation, and this is just the very spot where the gas company are proposing to come. The gas company's traffic would have been very inconvenient at this place, but that part of the scheme I understand they have abandoned.

Cross-examined by Mr. SOMERSET: Marshalling—that is collecting waggons together to form a train—should only be done on a line of some length. I would not collect my waggons in the immediate vicinity of the point of junction. I would take them to a place a quarter of a mile off, where they could be conveniently placed in length.

Re-examined by Mr. JEUNE: If I had a long straight line of rails I should prefer it for marshalling and distributing trains upon, but under the circumstances of this case, taking the facts as they stand, the spot proposed by the gas company is just the site that would be used by the railway company for that purpose.

THURSDAY, APRIL 29.

Sir *George Elliot*, Bart., was examined on the part of the petitioners, but his evidence was not material, and that concluded the case for the dock company.

Mr. BIDDER then reviewed the evidence on both sides, contending that it had not been made out that there was no alternative site, and insisting that it had been conclusively shown that the land proposed to be taken was required by the dock company for the new traffic that would flow in by the railways, and for the necessities and advantage of the public.

Mr. SOMERSET, in reply, rested his case principally upon the statement of Mr. Glascodine, in cross-examination, "that he would not collect his waggons in the immediate vicinity of the point of junction."

The room was then cleared, and, on the readmission of the public,

The CHAIRMAN said the committee were of the opinion that the preamble of the bill was proved, with the amendment that the gas company were not to take any land within the limits of deviation of railway No. 6, and the new road of the dock company was to be laid out so as not to interfere with the works of the gas company.

The chairman was directed to report the bill, as amended, to the House.

Legal Intelligence.

COURT OF CHANCERY.—SATURDAY, MAY 22.

(*Before Vice-Chancellor* MALINS.)

Re THE FOREIGN AND COLONIAL GAS COMPANY.

This was an application by Mr. G. Bower, who is a debenture-holder in the Foreign and Colonial Gas Company, that notwithstanding that the company was ordered to be wound up in December last, he might be allowed to prosecute his suit against the company, the bill in which was filed in January, 1874.

Mr. GLASSE, Q.C., and Mr. BRADFORD appeared in support of the motion; and Mr. NAPIER HIGGINS, Q.C., and Mr. MONTAGU COOKSON for the official liquidator, and Mr. ANGELO LEWIS for other parties to oppose the application.

The VICE-CHANCELLOR said that the onus was on the official liquidator to show that the suit ought not to continue. Mr. Bower claimed other rights than those of an ordinary debenture-holder, and he (the Vice-Chancellor) was of opinion that the decided cases in which the suits were stopped did not cover the particular point. He should give Mr. Bower leave to prosecute his suit.

KNARESBOROUGH PETTY SESSIONS.—WEDNESDAY, MAY 19.

(*Before Messrs.* DENT *and* LOCKWOOD.)

OBSTRUCTING A GAS COMPANY'S OFFICERS IN THE REMOVAL OF A METER.

Mr. *T. T. Powell* of Harrogate, was summoned by the Harrogate Gas Company for hindering certain of their officials in the performance of their duty.

Mr. DENHAM appeared for the defendant.

It appeared that on the previous day the complainant sent some workmen to inspect and remove the meter from the North-Eastern Hotel, Harrogate, a notice having previously been sent to the landlord, Mr. Matthews. After the man had detached the meter from the main-pipe, they were ordered by a man named George Sharpe to leave it alone, he saying that he would arrange the dispute. Sharpe also said he would go and see Mr. Powell, and shortly afterwards that gentleman arrived and locked the door of the cellar in which the meter and the men's tools were. Defendant refused to allow the men to remove either the meter or their tools, and they were yet in the cellar.

In defence, Mr. DENHAM said that Mr. Matthews, who had been landlord of the hotel a short time, had fallen into difficulties, and late on Saturday evening last made an assignment to his creditors, the defendant being one of the principal. Sharpe was put into possession about 10 o'clock the same evening; the gas bill, amounting to £27, was found, and it being then too late to pay it, and Monday being Whit-Monday, it was thought the office would be closed. Before nine o'clock on Tuesday morning the men went to remove the meter. Mr. Powell did lock the cellar door, his reason being that he did not wish the meter to be taken away, as it would have to be taken back again the same afternoon, it being impossible for the hotel to be without gas. He also wished to consult a solicitor before paying the bill.

After a short consultation, the BENCH expressed an opinion that the summons should be withdrawn on condition that the expenses should be paid by the defendant, who must also deliver up the meter and the tools. There would have been a conviction, only they thought the gas company had been rather quick in sending the men to remove the meter.

NORTHALLERTON PETTY SESSIONS.—WEDNESDAY, MAY 19.

(*Before the Rev.* J. FIELD, *Chairman, and other magistrates*).

SUMMONS FOR DISCHARGING GAS REFUSE INTO A RIVER.

The directors of the Northallerton Gas Company, Limited, were summoned by Mr. M. Walmsley, the deputy chief constable of the North Riding, for that they, on the 29th of March last, "did unlawfully and injuriously convey and suffer to be conveyed great quantities of noxious and offensive liquid matters, scum, and refuse from the making of gas, and of coal tar, and ammonia water, from certain premises of the Northallerton Gas Consumers Company, Limited, situated in the township of Northallerton, into a certain ancient stream of water called the Willow Beck, or North Beck, thereby causing a common nuisance."

Mr. DALE, solicitor, appeared for the prosecution. The facts of the case were that about a fortnight previous to Monday, the 29th of March, the directors of the Northallerton Gas Company held a meeting, at which it was resolved that a tank upon their premises, in which gas tar, ammonia water, and other refuse liquid from the manufacture of gas had accumulated for a period of 40 years, should be emptied into a stream adjoining the gas-works, in order that the tank might undergo certain repairs. Accordingly directions were given to Mr. John Marshall, the manager of the works, that this tank should be emptied, and that the liquid matter and refuse of gas manufacture in the tank should be turned into the stream referred to. On the 29th of March, Mr. Marshall engaged three or four men to do this work, which occupied from eight o'clock in the morning until a late hour in the afternoon. Thus the whole of the foul liquid matter was emptied—a considerable portion of it running into the sewer adjoining the gas-works. From the sewer it was conveyed into the river Wiske, and thence into the river Swale. The effect of this was the destruction of thousands upon thousands of fish; in fact, almost every living thing in the Wiske perished. The water in both the rivers Wiske and Swale was also rendered wholly unfit for human consumption. As soon as the foul matter arrived in the stream, persons who resided adjoining the river experienced an offensive smell, which was considered injurious to health.

Before the case was gone into a consultation took place, which resulted in

Mr. DALE making the following statement to the court: I dare say you are aware that I appear before you on behalf of several gentlemen, who are landowners adjoining the river Wiske, who feel themselves deeply interested in the present inquiry. I find that during the past half hour mutual friends on the part of those gentlemen and on the part of the several defendants have had a conference in my absence, and they have come to some terms in this serious case. The defendants have proposed these terms:—"The directors of the Northallerton Gas Company beg to express their regret if they have been the unintentional cause of the destruction of fish in the river Wiske, through the discharge from their works of a quantity of water pumped from the gasometer-tank, and will undertake that no similar discharge shall for the future take place. They agree to pay £5 to the York County Hospital, and the legal expenses incurred to the present time. Signed—R. D. Coates, Secretary to the Northallerton Gas Company." My clients, of course, felt they were compelled to take the present proceedings, as a very serious public nuisance had been committed; but as the defendants have now made reasonable atonement to them, and expressed their regret for what they have done, and promise the same shall never be repeated, and have consented to pay £5 to a local charity, and the legal expenses incurred, they are willing to accept these terms in order that peace and good-will among neighbours may be restored and continued. I have, therefore, on the part of the gentlemen I represent, as well as on the part of the directors of the gas company, to ask the permission of this court to withdraw from the present prosecution upon these terms.

The CHAIRMAN: Well, Mr. Dale, we are glad that the matter has been so arranged. At the same time we think that your clients have shown very much forbearance, and have been very satisfied with a small compensation.

Mr. DALE: That is entirely my opinion. The arrangement is not made with my concurrence.

The summons was then withdrawn.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

The Annual Report of the Metropolitan Board of Works for 1874, which has just been published, thus refers to the water supply of London:—

Gradual progress is being made by two of the metropolitan water companies towards the realization of the purpose of the Metropolis Water Act, 1871, which was the substitution of a constant for an intermittent supply of water. The two companies referred to are the Kent and the East London, and they are proceeding in one district after another to arrange for their pipes being constantly charged. Reference was made last year to the movement of these two companies towards providing a constant supply of water in certain portions of their districts, and this year several further notices have been received from them of their intention to extend the system.

The East London Water Company proposes to give, on and after February 15, March 1st, April 1st, and June 1st next respectively, a constant supply of water in parts of its district situated in the parishes of Whitechapel, Wapping, Aldgate, Bethnal Green, Spitalfields, and Mile End Old Town. The Kent Water Company proposes to give a constant supply on and after March 1st and May 1st next respectively, in parts of its district contained within the parishes of Plumstead, Woolwich, and Charlton.

A committee of the board has had before it the results of a careful house-to-house inquiry made in those parts of the districts of the East London and the Kent Companies in which the pipes are now kept constantly full of water, and in which the owners of houses have altered their water-fittings in accordance with the companies regulations. The object of the inquiry was to ascertain whether the new mode of supply was more satisfactory than the old; whether and to what extent the owners and occupiers were inconvenienced by the necessity of conforming to the regulations under which the supply is given, and whether the cost of the alterations was unduly burdensome. These results, which are now before the committee, will be valuable as a guide in future action upon this question.

It was stated in the last report that the board had called upon the Kent Water Company to place a number of plugs and hydrants on the pipes in a certain district in the parishes of Rotherhithe and Deptford, within the company's water limits, which had been brought under the system of constant supply. The requirements of the board have been carried out by the company, and the working of the hydrants has been inspected by one of the board's committees. No decision has yet been arrived at on the question whether it is expedient to provide fire hydrants throughout the metropolis. The question which is receiving much consideration at the hands of the board, is obviously one of great magnitude, and prudence dictates the propriety of taking no measures beyond such as are merely tentative until, after full deliberation, a well-grounded conclusion shall have been arrived at.

RIVER POLLUTION, WITH SPECIAL REFERENCE TO THE IMPURE WATER SUPPLY OF TOWNS.

At the Ordinary Meeting of the Society of Arts, London, on Wednesday, May 12—R. RAWLINSON, Esq., in the chair.

The following paper was read by Mr. JABEZ HOGG, Surgeon to the Royal Westminster Ophthalmic Hospital, President of the Medical Microscopical Society, Fellow of the Royal Microscopical Society, &c.:—

River pollution is a subject which has assumed, from facts which have recently come to light, the gravest and widest importance. In a well-arranged and lucid lecture, Mr. W. Thorp dwelt with considerable earnestness on the extent of the evils produced by manufacturers, trades, and mining operations, which have so much increased of late years. He also pointed out that, although the pollution of our rivers was formerly due to ignorance and carelessness, this plea would no longer prevail, since the late Royal Commissions had so well and so fully explained the various methods to be employed for impounding and collecting noxious matters, and so preventing them passing into the bed of the river. It was also clearly explained that certain portions of the refuse might not only be collected, but made marketable.

If manufacturers still refuse voluntarily to engage in a course so commendable and proper, it remains for the Legislature to enforce the valuable recommendations of the Royal Commissions of 1865 and 1868. It is hoped, and reasonably expected, that business men will perceive it to be to their interest, as well as the public good, that a remedy should be applied for evils which, throughout the length and breadth of the land, are regarded as intolerable.

There must, however, be no halting between two opinions, and masters must give stringent directions and orders to workmen not to cast rubbish and refuse into neighbouring streams, simply because it happens to be an easy and ready way of getting rid of them. Subsidence reservoirs must be established to collect all noxious matter as it passes out of the factory or mine. By simple means, and at a trifling cost, subsidence can be easily carried out, and in about six hours all the coarser matters held in suspension in water will have been deposited, and an enormous amount of the river pollution entirely prevented; but as precipitation is hindered by the slightest movement of the body of water, subsidence ponds may become failures, and the immediate results less satisfactory than was expected.

We cannot shut our eyes to the fact that many poisonous substances, culpably allowed to flow into our rivers near densely populated towns, are of a highly dangerous character. Numerous instances have occurred of mysterious poisonings of shoals of fish, and of the almost sudden disappearance of all vegetable and animal life. In some colliery waters arsenic abounds, as at the Dowlais Iron-Works, near Merthyr Tydfil. At the Devon Great Consols copper mines, arsenic is prepared for sale, and the refuse is generally allowed to pass into the river. Arsenic, however, is largely employed, and is indeed a positive necessity in certain important branches of British industry. It is used in the manufacture of the new colouring matters obtained from coal tar, in calico printing, in dyeing, in the manufacture of glass, shot, &c.; but this, I venture to say, is a matter of no moment compared with the conservation of the public health, which is paramount to every other consideration. This will be perfectly clear when I state that every ounce of this virulent poison will kill a hundred strong men. It is, then, only exercising a reasonable amount of caution if we demand that every effort shall be made to prevent so poisonous a substance finding its way into our rivers. It is desirable to prohibit altogether the discharge of metalliferous liquids from tin-plate, galvanized iron works, &c., into town sewers; and, while such a precaution will inflict no great amount of hardship upon manufacturers and tradesmen, it will certainly be a means of lessening danger to human beings, and also of preserving valuable property from injury, inasmuch as the cement and brick-work of the sewers are soon corroded, and leakages produced from this cause. For the same reason, the discharge of all refuse from chemical, nickel, iron, steel wire, German silver, electro-plating works, and brassfoundries should be strictly prohibited. Calico printers, flax steepers, linen and jute bleachers, dyers, woollen manufacturers, tanners, starch and paper makers, paraffin oil distillers, sugar refiners, chemical manure makers, &c., all conduce to the dangerous contamination of the river, and render it totally unfit for domestic uses. Trades which were at one time thought to be innoxious, upon closer examination prove to be seriously detrimental to the health of man and beast. This cannot be more forcibly exemplified than by stating what occurred only a few years since in a stream, on the banks of which a starch manufactory was situated, near Nottingham. This factory emptied all its refuse into the river, and soon the fish were found dead on its banks; and then the sheep, and lastly the cattle, were found poisoned. When attention was turned to the water, it was discovered that by no filtration or self-purification could its deadly impurities be separated. In another case, a paper manufacterer of my acquaintance noticed scores of dead fish in his mill-stream, and, on inquiry, it was discovered that the refuse of the factory was allowed to pass into the stream. The chlorine and other poisonous matters used in the bleaching process were quite sufficient to explain the deaths in the stream, from which a good supply of fine fish was before obtained. A still more recent illustration was lately given by the Duke of Buccleuch, at a meeting held in Edinburgh "On the Pollution of Rivers." The duke stated that in a Scotch parish the sanitary authorities diverted the sewage of a village into what he well remembered as a fine stream of water, and, in consequence, it had become so much polluted, that the tenants had been unable to use the water for domestic purposes, and even the cattle refused to drink it. The people were consequently obliged to cart every drop of water for their own use and that of their animals at a considerable expense. Furthermore, that "during the drought of last summer the Teviot was almost dry, and at Hawick there was scarcely any water to be seen, except what flowed along the mill-lade. In consequence, there was an immense accumulation of wool-dust and dyes in the pool immediately below the town of Hawick. It collected there for several weeks, when a heavy thunderstorm came on, and the river rose suddenly about 18 inches, and the water came rushing down and swept away all the abominable accumulations. The result was that fish in the river, even eels, from Hawick to Jedfoot, were killed and found lying dead in hundreds along the banks of the Teviot." The baneful effects of accumulations of filth, and the culpable neglect of sanitary authorities in suffering pollutions to arise in this way, is highly reprehensible, and cannot be too strongly condemned. It was not until the visitation of the cholera in 1854 that the eyes of the inhabitants of this metropolis were opened to the fact that the rivers were liable to become disease-carriers, and a means of spreading infection far and wide. It was for the first time clearly understood that the muddy Thames was receiving a deadly poison from the hundreds of sewers flowing into it, and persons were not slow to comprehend that the very source of the prosperity and commercial greatness of the metropolis had become converted into a channel of cholera and fever.

It was also, during the same memorable visitation of cholera, palpably shown that, in those localities where river water was deficient in quantity and very bad in quality, the disease attained its greatest virulence, and the death-rate was highest. Since then a great effort has been made to purify the Thames, but, owing to the rapid increase of population and greater desire to live out of town, the pollution of the river still goes on. Thames waters, collected at their source in Gloucestershire, are, no doubt, for a few miles pure, but when they reach the first populated town they no longer remain so, but become impregnated with sewage; and the river, as it passes through Maidenhead and

on to Teddington—the intake of the water companies—becomes a recipient of all kinds of refuse matters. A little further on, at Richmond, the incessant traffic of river steamers, barges, and small craft, all tend to keep the water in a state of perpetual commotion, and thus living and decaying organic matter is mingled and carried about with every ebb and flow of the tide; so much so, that it is no uncommon thing to find, quite high up the Thames, organisms which belong to brackish water, as well as chlorides in quantities much larger than can be accounted for by sewage contamination. Some of the most constant kinds of these bodies are beautifully represented in these photographs which I have received from my friend, Dr. Woodward, of America. Their names indicate that they are of marine formation, but they are found quite high up the Thames. Some of them are magnified 1300 times.

The floating population, almost constantly living on the Thames, together with the inhabitants residing on its banks, were in the last census estimated at 900,000 souls, who, of course, have a prescriptive right of polluting the river; it is, therefore, manifestly impossible to draw water free from contamination from such a source. Indeed, if Parliament were to pass an Act to compel the inhabitants of towns residing near the Thames to divert forthwith all sewage and drainage from the river, it would take at least 50 years to accomplish; and it is exceedingly doubtful whether it would be possible to stop percolation of "ground water," while the surface drainage and flood water must, under any circumstances, find its way to the bed of the river as the natural outlet. The intake, storeage, and filtration of water taken from a tidal and navigable river, it will be seen from the observations made, are matters of serious moment. Major Bolton's report of the condition of the Thames water in December last, as supplied by the Chelsea Company, materially strengthens this view. He found the intake at Seething Wells was rapidly rising, and that water going into the filter-beds of the company "was rendered thick and muddy, while that in the filter-wells was opalescent and discoloured." This was accounted for by the condition of the Mole, a tributary of the Thames, which in wet weather is always turbid, and very often dangerously polluted with fæcal matter; nevertheless, it is poured into the Thames, and, when an excessive rainfall occurs, sends down very large quantities of marl and clay, which cause the river at this point to become exceedingly dirty and muddy. Should it, however, unfortunately happen that typhoid fever were to break out in any of the numerous cottages or houses situated on the banks of the Mole, its specific poison would find its way down with the mud into the filter-beds of the water companies, and thence be distributed to the metropolis. The Government inspector also found that the water of the Lambeth Water Company, about the same time, contained "living and moving organisms, while that of the Chelsea Company contained an abundance of such organisms, with fragments of woollen and cotton fibres, clots of the mycelium of a fungus, and fibres of partly digested or decomposed meat." As a remedy for such horrible contaminations, it is simply proposed to remove the intake a little higher up the river, and increase the size and number of the subsiding reservoirs and filter-beds. It is also broadly stated by some persons, that self-purification of the river is constantly taking place; but so crude an idea has been dispelled by Professor Frankland, who emphatically declares that "there is no river in England long enough to completely oxygenate and purify contaminated water."

It is only necessary to look to the very short courses of the rivers of England upon the beautiful map on the wall, which Dr. Frankland has lent me for exhibition to-night, to see that this must be quite true. The very largest river in England, the Thames, is 240 miles long, and when we compare such a river as that to such rivers as they have in America—the Missouri, for example, which is 4500 miles long—we can easily understand that, having large towns, densely populated, along its course, how utterly impossible it is to hope for anything like self-purification. This map, which was purposely prepared for the Pollution Commissioners, shows that all the rivers throughout England are contaminated by the impurities which pass through them.

As to the oxygenating effect of vegetable life, this, to me, appears equally fallacious, for weeds certainly increase mud accumulations, afford protection to fish, and become the breeding-ground of animal life of all kinds. In tropical climates we know that, from the rapidity and excessive growth of vegetable life, rivers become choked up, and malaria and death lurk about in places where we might expect to find only "streams of life." Those who believe in self-purification of rivers overlook the fact that there is an immense difference between clarification and purification. It is generally thought that if a glass of filtered water looks clear when held up to the light, it is quite pure and wholesome. Some persons imagine that a moderate impregnation of earthy matter is in no way injurious to health; but, as the ova of fish and other organisms are better concealed in muddy water, it is impossible to say what danger to health may arise when a dirty mixture is taken by a thirsty man.

London, at the present time, is supplied with water by the agency of nine large companies. Most of them enjoy the privilege of drawing their water supply from contaminated sources. The Lambeth, the Southwark and Vauxhall, the Chelsea, the West Middlesex, and Grand Junction, derive their water from the Thames. The East London Company draws its supply from the river Lea.* The New River is partly supplied by the Lea, from a source above Ware, and a variety of springs in the vicinity of Amwell and Herts, and from wells which discharge into the river; but the watercourse being open throughout the greater part of the way, admits of a good deal of contamination. A number of human beings, besides animals, are annually drowned in the New River as well as the Thames; and at some points it becomes the receptacle of garbage of every kind. Only two companies offer their customers water fit to drink—namely, the Hampstead Company, which takes a supply from springs and Artesian wells, and the Kent Company, which derives its supply wholly from deep wells sunk in the chalk.

I have here a number of specimens of the water, not perhaps arranged in the order of impurity, but drawn from the various sources of the London companies. Here [pointing] is a very bad specimen taken from a gentleman's house at Richmond, the cistern of which had not been cleaned out for three months. The deposit, however, is considerable in most of them. This [pointing] is a bottle of spring water taken from an Artesian well on June 27, 1874, and you will see that no change has taken place in it. This is an effective answer to those who say that the deep well waters are soon contaminated by vegetable matter growing up. This water is as pure as when pumped up at Selby.

Of the companies water drawn from rivers, it may be asserted that they are characterized on standing, by the formation of a deposit loaded with vegetable and animal organisms. Microscopical examination of the deposit shows that living animals, filariæ and larvæ of the most noxious kinds, abound in the cisterns of their customers, in their mains, and in the intervals between the filter-beds and the consumer, and it is therefore idle to look to engineering skill for their removal by present arrangements. It will therefore surprise no one to hear that from some of the house-cisterns, in the best parts of the town of Richmond, were taken, during the three months of last year, small fish, eels, and numerous noxious living animals. Experience proves, beyond a doubt, that Thames water can be made to look clearer and brighter by being taken into reservoirs and passed through beds of sand, gravel, and other materials, but only the coarser matters are arrested; while during summer and hot weather the filter-beds become choked and fouled by the accumulated remains of dead animal and vegetable matters, and then the filtration ceases, the beds become inoperative, and loaded with refuse matters dangerous to health.

* The chairman reminded the lecturer that, under a recent Act of Parliament, the East London Company now draw water from the Thames.

It is said that to take specimens of water from house-cisterns for the purpose of reporting on its salubrity is unfair towards the companies, but my reply is that when, notwithstanding attention to periodical cleaning, living organisms are found, it proves that they must have been brought in through the company's mains, and in no other way, and therefore should be taken as an evidence of contamination. A covered cistern, excluding as it does light and air, would certainly not be likely to assist in increasing vegetable or animal life. It is perfectly certain that the filtration of water, as carried out by the companies, merely separates or sifts out the coarser particles of organic matter, while the more subtle and dangerous organisms are held in solution or suspension. We have only to inquire into the formation of the filter-bed to see this at a glance. One-third of the bulk of the most compactly made filter-bed consists of pores or holes, through which air as well as water, and the germs of animal life easily pass. That is, 30 volumes of water can be poured into a vessel filled with 100 parts of graval and sand, without causing the vessel to overflow; indeed, substances far more compact and solid than filter-beds contain numberless pores, whose combined volume forms a considerable portion of the bulk. The best and most compact sandstone used for building will absorb from 5 to 6 per cent. of its own weight of water. A brick will absorb half a pint of water; it is so porous that, without much effort on the part of the blower, it can be blown through.* It is, then, a fallacy to suppose or believe that the coarse-grained materials of which filter-beds are composed, will strain out minute organisms, thousands of which are contained in a single drop of water.

Another source of danger often overlooked is the percolation of the ground and surface waters into the bed of a river. At low water numbers of small streams will be seen oozing from the sides of the Thames bank, and flowing along over the mud into the stream. In this way a considerable quantity of polluted water finds a ready exit through the porous surface soil. Indeed, the more superficial stratum of earth is not so solid as it may look; consequently, air, gases, and "ground-water" make their way through it to the natural source of drainage, the tidal course of the nearest river. The noxious state of the "ground-water" depends upon the sanitary surroundings of the population, the rainfall, the artificial drainage, and the higher or lower level of the district. The pressure of the atmosphere, the substratum, and its direction, also exercise no inconsiderable influence over the rate of percolation of the "ground-water." Such modes and sources of pollution are liable to be quite overlooked, and may therefore go on to a far greater extent than is generally suspected. As evidence of the peculiar insalubrity of "ground-water" percolation, a single fact will suffice. Mr. Bowie, who was examined by the committee which sat on the inquiry as to the "water supply to the metropolis," stated that his grounds were close to the river Lea, and that the water of the river supplied to his house, during the prevalence of the potato disease, gave out the peculiar odour of the fungus, and in a very marked manner, and that this was noticed by very many of his neighbours as well as himself. Unfortunately for the metropolis and for those who have no better water to drink, the presence of sewage poison does not necessarily give out an odour, nor does it impart a taste or colour sufficiently palpable to ordinary observers, consequently those who partake of it remain in ignorance of the danger to health. Nevertheless, it is notoriously true, as the Registrar-General has often pointed out, that "the water supply is one of the most potent of the influences in determining the health and death rate" of this and every other town of the kingdom.

Some idea of the magnitude of the evils of water pollution may be gathered from the reports of the medical department of the Local Government Board just published, and in which it is stated that 141 towns have been visited, and inspections made into the cause of outbreaks of fever, &c., and in 104 instances the water supply was found more or less polluted, in some cases "seriously polluted;" and, as at Warwick, where typhoid fever prevailed, "scandalously filthy."

In illustration of the fact stated, that typhoid fever, diarrhœa, diphtheria, &c. have their origin most frequently in poisoned and impure water, I will give a few brief particulars of some of the more recently traced outbreaks of "filth-fever," which plainly shows, as the editor of *The Times* not inaptly observed, "that a cistern of impure water is often as perilous a thing in a house as a barrel of gunpowder," because at any moment "a spark of specific poison may create an explosion of malignant fever."

At Oxford, it will probably be remembered that several deaths from fever were reported among the undergraduates and about the town during the later part of last year and the beginning of this. In the month of November, the *Lancet* sent down a special commissioner, and he reported that the worst feature in the sanitary arrangements of the town was the reservoir of the water company. This reservoir, it appears, is formed out of an old gravel-pit dug out by the Great Western Railway. Several springs having been struck, the pit filled with water, and it was then taken by the water company and used as the chief source of the water supply. It turned out, however, that the springs set in from the adjacent river, through the loose, porous soil, and drift gravel. When therefore, the reservoir was first used, the water was tolerably good, for Dr. Child, who examined it in 1866, reported of it, "so far as organic impurity is concerned, it is greatly better than that distributed in London by most of the metropolitan water companies." In 1873, however, Mr. Donkin made an analysis of the Oxford water, and stated that, "in its present state, it is at least twice as bad as the average London waters." To what, then, could this great increase of organic impurity in the water taken from this reservoir be attributed? The answer is tolerably clear—to the rapid growth and extension of the suburb of New Hincksey, and the increase of human habitations surrounding the reservoir. The suburb of Hincksey is situated on an intervening bed of drift gravel, and is utterly undrained, and the cesspools and middens with which the place abounds are placed in a direction in which the springs set. In this way organic impurities and excretory matters find their way through the loose and porous soil, and the town of Oxford is supplied with what the *Lancet* commission not inaptly described "as the diluted sewage of Hincksey." This foul water supply has been more lately denounced by Dr. Child and the late Professor Phillips in strong terms of reprobation. In 1870, Dr. Buchanan also visited Oxford, and reported on its sanitary condition; and then strongly urged upon the authorities to adopt some scheme that would prevent the water supplied to the town becoming contaminated at its source. The officer of health, Mr. A. Winkfield, in his report for 1873, speaks of the water supply in the following terms:—

I cannot but feel that it becomes a matter of even greater importance every day, that all chance of the reservoir getting fouled by the sewage of Hincksey should be removed as speedily as possible, and the question arises whether it would not be highly advantageous to have the water from this lake carefully filtered previously to its distribution throughout the district.

* To show this, it is necessary to make the four sides of the brick air-tight by coating them over with wax, leaving the two ends uncovered, and to which two small funnels (having pieces of india-rubber tubing and glass mouthpieces attached) must be cemented. Soap bubbles can quite easily be blown through a brick and tubing measuring six feet or more, showing the very porous nature of the material. This experiment was devised by Professor Max von Pettenkoffer, of Munich. (See an excellent translation of his volume on "Cholera: How to Prevent and Resist It," by Dr. Hime, published by Baillière, Tindall, and Cox, London.) Nothing can be better calculated to show the insecurity of brick-built drains; how fallacious to suppose that percolation of sewage is not constantly taking place. I have tried the same experiment with the best stone used for building—the Kent sandstone—and found it quite easy to blow through. That stone makes an excellent filter for water.

In January, however, of the present year, no effort was made to even filter this diluted sewage—this unutterably poisonous and repulsive Hincksey mixture. Neither do we hear of immediate steps being taken to stop the spread of "filth-fever" in the collegiate town of Oxford.

The sanitary history of Lewes affords another striking example of the diffusion of filth-fever through contaminated water. It appears by the report of Dr. Thorne, of the Medical Department of the Local Government Board, that typhoid fever broke out at Lewes in December, 1872, and continued into the early part of the following year. Sixty-four persons were then attacked, seven of whom died; and isolated cases were heard of from time to time, but no precise record of them was kept. One such is known to have occurred towards the end of May, 1874, and it was followed by another in the same house early in June. Towards the end of July and in the beginning of August, the disease assumed an epidemic form; and between the 1st of August and the 14th of November, 447 persons were attacked, and 37 died. By the last-mentioned date, Dr. Thorne had discovered the probable origin and the principal channels by which the fever was diffused, and had made recommendations which at once arrested its progress. A few cases, however, still occurred, which raised the total number to 486 in the five months between the 25th of July and the 26th of December. The whole population of the place is only 10,753, and thus, in the course of the five months mentioned, no less than one person in every 24 of the inhabitants was stricken down. The mortality, which was one in 13, appeared so far to point to a copious dilution of the poison; but the report significantly says that, "as yet," only 37 cases had terminated fatally, obviously contemplating the possibility of an increased mortality after lingering illness. On the other hand, the diffusion was almost universal, extending to all parts of the town, and affecting all classes, those who were well-to-do in a somewhat greater proportion than the poor. It was, however, clearly shown that the water supplied by the local water companies was the chief, if not the sole, channel of diffusion, and hence that it must have been infected with sewage containing typhoid excreta. When the fever was once present in several localities, the source of subsequent infection was very evident, for it was found that some of the water-pipes were corroded and leaky, that others were left open over drains leading to the sewers, and the supply of water was intermittent. When the mains were empty of water, the vacant space was filled by anything which could get in, and there was abundant facility for the entrance of sewage air and absolute sewage. The cause of the commencement of the epidemic was far more difficult to determine, but this also was at last cleared up in a satisfactory manner. The water supplied by the company was obtained from three sources, two of which were beyond suspicion. The third source was the head water of a stream, called the "Cockshute," which empties itself, after a short course, into the tidal river Ouse, into which all the sewers of Lewes fall. In July the water of the Ouse was very low, and then the ascending tide would roll back a considerable stream of sewage along the river bed, and also up the Cockshute. In order to protect their source of supply the water company had placed a valve across the Cockshute, to prevent the tide ascending higher than a certain point; and, as long as everything was in good working order, the protection thus given was said to be complete. It had pleased certain persons, however—presumably children playing in an adjacent meadow—to place some boulders of chalk in such a position that they prevented the tidal valve from closing, and these boulders were discovered by the medical officer of health at the end of August, when they presented appearances which left no reasonable doubt that they had been there for a considerable time. While they were so placed the tide would ascend freely, and if at any time a tide of sufficient height were flowing when water was being pumped from the river, the pumps could hardly fail to take up tidal water, or at least to take up the returning wave of sewage which the tide would drive before it. These conditions were fulfilled on the 13th of July, and there can be no doubt that on that day poisoned water was pumped into the reservoirs and sent out through all the mains of the company. Dr. Thorn reproduced the conditions experimentally during a high tide on the 11th of November, and obtained a turbid flow from the Ouse towards the head of the stream, and past the inlet of the water-works, before the tide had reached its highest level. Such an occurrence on the 13th of July would fully account for the epidemic outbreak, and the conditions already mentioned would account as fully for its subsequent extension. In an old town like Lewes much time and much vigilance will be required in order to remove all such sources of danger; and, even with all practical care, the seeds of typhoid fever are far more readily sown than destroyed. The story of the tidal valve should teach the important lesson that no one must ever rely for the preservation of health upon construction alone. The best possible construction is liable to be deranged by accident or mischief, and systematic inspection is always necessary for safety.

The outbreak at Over Darwen is another case in point, and, as it clearly conveys an accurate knowledge of the conditions under which the enteric, or filth-fever, may be produced, I venture to state the circumstances which led to the return of the fatal typhoid in October, 1874. The unwholesomeness of Over Darwen has long been notorious, and has more than once been the subject of official inquiry; and twice within the last 20 years (1861 and 1874) has filth-fever become suddenly and very fatally prevalent in the town. The history of the recent outbreak and of its source is as follows:—Over Darwen is a town lying in a valley, on a gravelly subsoil, among the Lancashire uplands, and it consisted at the last census of 4225 houses, in which lived 21,273 persons. It draws its water supply from a rivulet two miles away from the town, and under conditions where no reason exists, except that of careless indifference, why the water should not be fairly good and pure. In reality, various impurities find (or until very lately found) their way into the water from farmyards, cesspools, and other sources, in the township of Tockholes and elsewhere. The sewerage of the town is imperfect and insufficient (many streets are wholly undrained), and the arrangements for excrement and refuse disposal would appear to be almost unique in filthiness, even among the many filthy arrangements of some northern towns. The excrement, as a rule, accumulates in cesspools, of which the possibility of their being cleansed may be estimated from the report made by Dr. Stevens. Of the local official arrangements for scavengers, he says:—

> My informer stated that it was the practice to empty three cesspools each night—that is, when they knew of any neighbouring farmer who would take the contents—and they carted the excrement in a semi-fluid state, and so poured it out on to the fields. Some farmers paid for the manure, and they were served first; some would only consent to take it without paying for it, and it often happened that that no recipient could be found. Then no cesspool-emptying took place.

On the 11th of September, a young lady, suffering from fever, was brought to Darwen, to a house on the hill-side overlooking the town. She died there on the 12th of October. It appears to have been from this one case that the great outbreak took its rise. The house is situated close to the sough by which the water for the town supply is conveyed into the service lodge. The excreta from this patient had been carried away by a water-closet, the drain from which discharged on to a meadow in front of the house, and passed in its course immediately over, and within two feet of the sough carrying the town water. The father of the deceased expressed himself as tolerably assured that no contamination of the water could have arisen by means of the drain in question, more particularly as the water company had some years since examined the drain channel here, and done what they considered necessary in order to secure the water against accidental pollution from this source.

On examination of this drain, it was found to consist of a stone sough, leading from the front of the house to the other side of the road, whence it was continued by some earthen drain-pipes a few feet down a bank, and then onwards under a footway by means of an iron pipe, the end of which farthest from the house was left open, so that the sewage might flow out over the sloping meadow, stretching thence to the houses below. The part of this drain from the commencement of the iron terminal pipe is in relation with the public water supply sough. On removing the earth above and around this portion of the drain, it appeared to have been fairly well laid, and betweeen the iron pipe and the water sough some excellent puddling had been used, probably the work of the water company on the occasion of their inspection above referred to. This puddling, however, was confined to the space between the iron drain-pipe and the water sough. Further examination of the iron pipe showed it to be almost absolutely choked up, no fluid running through it except as the result of considerable pressure; and on similar examination of the earthen drain-pipes, they, too, were found to give little or no passage to sewage. This had evidently been the case for some time, and the sewage had found a ay for itself outside and underneath the drain. Here the sewage had met the water sough, against which it had formed a kind of small cesspool, which was found to contain a quantity of black sewage matter. This matter, containing, be it remembered, the specifically diseased excrement of enteric fever, had, during the latter half of September, gained access to the interior of the water sough through faults in its imperfectly secured joints, and was, with the water, delivered to the houses of the town.*

Dr. Strange, medical officer of health of the city of Worcester, carefully traced the outbreaks of typhoid fever in his district, to impurities, the chief among which appear to be the water. "In 99 cases out of every 100," he writes, "fever is bred of a poison generated in decomposing putrid animal matter, dissolved or suspended in water, and taken into the stomach in drinking water. There, possibly, it multiplies and generates a true contagium, which, again added to drinking water, becomes, if this be already foul, a still more virulent poison, in a more active state than that which first induced the fever."

A few weeks since I received the report of the officer of health of the Selby Union. The town of Selby is situated in the centre of a wide alluvial plain, termed the Vale of York, and receives a constant and ample supply of pure water, obtained from Artesian wells, sunk 336 feet into the new red sandstone. The yield of water, which appears to be inexhaustible, is excellent, and the health of the town population is reported as very good, but just outside the town there are groups of small houses and cottages, which, although sparingly populated, are constantly infected by filth-fever. The water supply of the district is very inferior; it is drained from shallow wells, and a polluted river, and by a filthy arrangement of privies and pigsties, the earth, the air, and the water are poisoned. The result is that fever and infectious diseases are very prevalent, and the mortality is proportionately heavy.

Dr. Parsons attributes the unhealthiness of this part of the union chiefly to the water, which, he says, "is of very inferior quality, containing normally large quantities of animal and inorganic matters, which in some instances are derived from the alluvial or peaty soil, but more often from the percolation of filth of drains, privies, farmyards, &c.; such water has a yellowish colour and a mawkish taste; it is always very hard, for the acids produced by the oxidation or organic matters will dissolve out of the earth more lime (urate of soda) than pure water can take up. Among the samples of water from the Selby rural district analyzed by me during the past year, the degree of hardness has varied from 14·5° to 52°, the solid matter in solution being respectively 32 and 160 grains per gallon. The first specimen was taken from a surface well in a sandy field at Burn. The second from a well at Bristow, with a manure heap 3 feet from its mouth. Two deaths, one from diarrhœa, and the other from diphtheria, occurred during the year among the poor people who used the water of this well."

When such wells are closed, the inhabitants are driven to use the water from the river which flows through the district, and this is generally more or less muddy and contaminated with the sewage of the various towns situated on its banks, and which in summer time abounds in living organisms.

Dr. Parsons laments the defective state of the law with regard to the water supply, and which puts so many difficulties in the way of rural sanitary authorities. "At the present time," he observes, "an owner may be compelled to provide a proper supply of water to any house that is without one, if such supply can be had 'at a rate not exceeding 2d. per week;' but the view expressed by the Local Government Board, in a correspondence which I had with them upon the subject, is, that the enactment referred to does not apply to cases where the water supply to a particular house can be obtained by digging a well." Again, by the Sanitary Law Amendment Act of 1874, power is given to close polluted wells, but there is still no power to compel a landlord to cleanse, puddle, and repair them, or to keep the pump in working order; so that, if he chooses to neglect his property, he may compel the occupants of his cottages to go without water, or drink that from polluted sources, rather than he should be put to the expense of keeping the well in a sound and wholesome condition.

Typhoid, enteric, or filth-fever, however, is not the only fatal specific disease engendered by partaking of poison-polluted water. An epidemic of contagious sore throat, passing into scarlet fever, diphtheria, and typhoid fever, occurred last year at the Cripples Home, and this was most clearly traced by Dr. Routh to the contaminated water supply. In this home all the water drinkers were attacked, and many deaths took place, while, remarkable enough, the beer drinkers escaped the fatal maladies. Diphtheria is a specific contagious disease, mostly produced by insanitary conditions; and when several cases occur in close proximity to each other, may always be traced to sewer gases or contaminated water. Diphtheria, in fact, bears the same relation to these causes as does typhoid fever. However, in the Cripples Home every care appears to have been taken to secure a pure drinking water, for "all water drunk by the inmates was received into a large funnel-shaped receptacle, kept constantly full by a ball and a tap in connexion with the water service, and the water was made to filter through seven or eight layers (each layer about an inch thick) of silver sand and animal charcoal. Both these latter agents were made red-hot before being used, or at least put into crucibles, to be purified of any impurities, vegetable and animal matters. The sand was also boiled in two or three quantities of boiling water before being calcined. The water was made to fall from a height into a reservoir, and was exceedingly well filtered and aërated, and, to the taste, appeared to be unexceptionable." Nevertheless, with all this care and attention, it was ultimately discovered that a faulty water-pipe admitted of a very slight sewage contamination, and there was not a shadow of a doubt that the filth-fever and diphtheria, which had for months afflicted the inmates of the house, were due to the water, for the moment the defective pipe was discovered, and the source of contamination removed, the epidemic visitation disappeared. Dr. Routh says, "I confess I was much surprised, after all the care I had taken to supply the house with good water, to learn the reverse had been the result."

No peculiar, disagreeable flavour of the water was observed before the months of August and September, a period of the year when decomposition takes place more rapidly; but, although it was more evident just at that time, it had probably existed for months before. It should be remarked, however, that in this instance the most scrupulous care had been taken to refilter the company's water; and I give this case since it remarkably bears out the opinion, before expressed, that by no process of filtration at present in general use will contaminated water be rendered much less noxious or dangerously poisonous to those who may partake of it, should it unfortunately contain specific poison germs.

"The water-drinking disease" is well known in some parts of India, and, from a report made by Dr. Balfour to the Indian Government, we gather that it prevailed in the Tinnevelly and Madura districts to an alarming extent during the hot months of last year. Unfortunately enough, the prominent feature was thirst, and from the constant desire for water, the native people give the

* It is noteworthy that the previous sudden outbreak of enteric fever in 1861 appears to have been brought about by some similar pollution of the public water supply. The disease was in that year traced from Withnell, a hamlet about four miles from Darwen, to Ryals Farm and the new village of Tockholes, and it was almost immediately after its appearance in Tockholes that the outbreak occurred in all parts of the town of Darwen. It has been before stated that the drainage of this very place, Tockholes, used habitually to run into the town's water.

disease the name of *Tannir-hudi-Novu*. Mr. Boyle, the head assistant collector, reports 67 cases of the disease; while the collector of Madura makes mention of 120 in the neighbourhood of Perumali on the Tinnevelly frontier; and the Zillah surgeon of Tinnevelly furnished a statement of 52 cases in the town of Ettiapuram and 13 deaths. The cause of the disease was chiefly due to the scanty and bad water supply.

In the hot months of April, May, and June, a few people in other villages, who were seen by first-class hospital assistant Brown, and reported on by him, died from ordinary natural causes—to wit, fever and diarrhœa. The drought being excessive, the tanks, wells, and channels became gradually dried up, and the people, instead of having pure water to drink, had to partake of mud and water, which, abounding in saline matter, necessarily inducing thirst, and the thirst being aggravated by the undue consumption of a new grain, a diarrhœa was the result, and very often proved fatal.

Mr. Brown stated to Mr. Lincoln that first the patients complained of a bitter taste in the month, then low fever came on, and necessarily thirst followed. The people wanted water to drink, but no water was to be had. Mr. Lincoln remarks: "This subject of water was of vital importance, and I beg to submit that it is one which the local fund board should take up, and provide water for the poor population of the district, situated miles away," and adds, "The condition of these villages can easily be imagined when it is stated that there was no water for purposes of ablution."

On the Continent, it was almost universally admitted that the most prolific source of typhoid fever is impure potable water. Instances have greatly multiplied of late of the evils and dangers of an escape of sewer-gas into water-cisterns, and scarcely a medical man will deny that it is the great cause of the occurrence of epidemics of enteric, "dirt-fever" in our town populations.

Typhoid fever is of comparatively modern growth amongst us; and whilst some attention has been bestowed upon drainage and improved modes of living, and which doubtless have stamped out a terrible disease, known to our forefathers as plague, from sheer carelessness and indifference we have introduced the more modern, and, I was about to add, more fashionable plague, properly designated "filth-disease." Upwards of a hundred thousand victims are annually offered up in England to this modern Moloch zymotic diseases; arise out of neglected sanitary precautions; and to a polluted or scanty water supply a very large proportion of such diseases as diarrhœa, dysentery, diphtheria, typhoid fever, &c., are due.

The extremely objectionable and highly dangerous nature of river pollution is, I venture to think, scarcely at all understood by the general public, or Parliament would have been moved to legislate for its prevention long ago. Indeed, its important bearing upon the health of town populations by those in charge of sanitation, and whose duty it is to guard it by every means in their power, seems to be but very imperfectly recognized, otherwise we should not witness the lamentable amount of ignorance displayed, and put forth with a stamp of authority which is surprising, if not remarkable. In December last, a report of a professor of chemistry, on the state of the Loch Katrine water, contains the following remarks:—"The water supply, although slightly yellowish and turbid, was as usual free from all traces of previous sewage or animal contamination," and it was thereupon pronounced perfectly fit for use as a potable water. This opinion was, I have not the least doubt, arrived at without any attempt to show by the aid of the microscope whether this fine specimen of Glasgow turbid drinking water contained water-fleas or filariæ, and such a report must be utterly worthless, if intended to protect the public health. The officer of health of Birmingham also writes of the water supply: "It is pretty clear"—whatever such an adjective may mean in connexion with bad water, "but, again, I have to draw attention to the large amount of organic nitrogen which it contains." Why attempt to disguise the fact that Birmingham water contains an amount of impurity which is highly dangerous? Dr. Frankland does not hesitate to call a spade a spade, and therefore unhesitatingly wrote of the Chelsea water, "It is muddy," and of the Lambeth, "It is turbid, and contains living moving organisms, and both are unfit for dietetic purposes, and could not be used without serious risk to health." That the water supply of Birmingham is dangerous to health Dr. Balthazar Foster stated at the Sanitary Congress in January:—"Birmingham was the worst town of all, except Liverpool and Sheffield, as regards the proportion of zymotic deaths to deaths from all causes." I specially refer to this, because these diseases are what we call, and call properly, "preventible diseases"—diseases which depend for their propagation on neglect of sanitary laws—diseases which admit of being partially (some would say very largely) stamped out." And the medical officer of the Privy Council in his report on the causes and prevalence of diarrhœa in Birmingham says: "The excess of mortality has been coincident with one or other of two definite local circumstances, the tainting of the atmosphere with the products of organic decomposition, and the habitual drinking of impure water." It is fairly estimated that over 140,000 people in the town of Birmingham are compelled to use water impregnated with sewage, and since they can obtain nothing better, the consequence is that the mortality, among the infant population especially—children under five years of age—from diarrhœa, diphtheria, and fever is something truly lamentable.

Of the lamentable amount of ignorance that too generally prevails on this question, I will trouble you with only a single example, taken from the columns of the *Surrey Comet* of May 8, 1875. The learned counsel who represented the interests of the Southwark and Vauxhall Water Company in an inquiry before the Government Commissioner, on the alleged deficient quantity and defective quality of the water supply of Richmond, said:—

> The quality of the water was a more important question than its deficiency, but what was the evidence of this? There was a fish brought, and an "alligator" was produced; but these things did get into cisterns sometimes, and the liveliness of the animals spoke in favour of the quality of the water than otherwise. Whether the fishes got into the cisterns through the company's pipes, or whether little "Jackey" put them in, he could not say; but at all events there was nothing serious in having a little fish in the cistern. If he found one in his he should rather be amused than otherwise, and should give it to his little grandson to play with. Of course, the scientific evidence was more important. But, again, he said there was nothing in it to satisfy the Local Government Board that there was anything deleterious in the quality of the water supplied. The evidence of Dr. Frankland, Mr. Jabez Hogg, Dr. Thudichum, and others, caused him nothing but amusement. He read the evidence to his family, and the roars of laughter which followed were highly amusing. He had not enjoyed such good spirits for a long time. If their statements were true, people would drink no water at all, and would have to abstain from animal food because the animals drank it. . . . And then referring to the drawings of magnified animalcules that had been produced, Mr. Lloyd asked how the cyclops, the filaria, and bacteria were obtained. It was said that they were found in a drop of water, but this was not correct. They were the produce, as Dr. Letheby told them, not of a drop of water, but of 50,000 drops, from which these animals were cleverly extracted.

Now it is quite unnecessary for me to point out the mischievous folly of such talk, and if the learned counsel should see fit to crack his jokes over his own dinner-table, and prefer, as he declared he would, to "drink the company's water, and stand the chance of swallowing bacteria," no one would for a moment think of interfering with the indulgence of so morbid a taste; but when he employs such nonsense as an argument for the use of polluted water, then, I think, we who know the danger to health have a right to ask for legislative protection for the public.

It certainly can make no difference whatever whether I exhibit under the microscope the concentrated essence of 50,000 drops of water or of one drop, since it has been conclusively shown that, if the specific poison of dirt-fever be present in the larger quantity, and which is one much below the average daily consumption of man, woman, and child, that quite enough will be swallowed to produce illness and endanger life; and, whatever Mr. Lloyd may think or say to the contrary, it certainly is no laughing matter to know that thousands of lives are annually sacrificed to polluted water drinking. The members of the profession to which I have the honour to belong engage in these inquiries from a simple desire to fulfil their duty to the public, and their only object in engaging in controversies on the public health is that they may extend their means of usefulness to mankind; and whether as regards the cure of individual cases of disease, or the larger and more important acts of preventive medicine, feel that they better fulfil their duty to society by acting in the interests of the masses, rather than those better able to take care of themselves.

An overwhelming amount of evidence has been collected together, showing that water tainted with the specific poison of sewage is capable of producing a terrible amount of mortality. Two years ago certain infected cans of milk came from a farm to London; the contents of the cans were distributed in the usual way about Marylebone, and scarcely a household that partook of the milk escaped fever. This was followed by several deaths. On inquiry, it was discovered that the milk-cans, before being filled and sent off, were washed out with sewer-contaminated water, and filth-fever was thus distributed far and wide among the inhabitants. The same deadly poison was for several days sold by a dairyman of Islington; but, in this instance, polluted water was used to adulterate the milk, and scatter broadcast dirt-fever. Among living organisms found largely mixed in river and sewage-contaminated water, the larvæ of entoza, and paramœcium among entomostraca, are most active agents in certain forms of disease. The latter are known to produce a remarkable feverish state, ending in death. At Dorpat, Sweden, an epidemic visitation of fever was traced to the presence of paramœcium, and numerous deaths occurred at the time. Fish, frogs, newts, and other animals have been killed by these noxious creatures, while other entomostraca, as cyclops and daphnia, multiply very rapidly, and often impart a red colour to the water. In Boston, America, the water during summer was much contaminated with water-fleas, and water drinkers continually suffered from diarrhœa, dysentery, and other fatal disorders. The larvæ of filariæ, and fully developed filariæ resemble the much-dreaded trichnia; and these are often conveyed into the intestinal canal by drinking water, while other forms of embryonic nematode worms find their way into the human stomach by the agency of the fish eaten. It is no uncommon thing to find some fresh-water and some salt-water fishes infested by such pests. The larvæ of some entoza have been found in the eyes of fish, of turtle, and of the human being. Domestic poultry suffer from a destructive disease termed "the gapes," and the worm causing it kills eight-tenths of the young chickens, turkeys, &c., of poultry yards. Pheasants also suffer from the same kind of worm, which, having once got possession of the throat, clings to the loose mucous membrane, breeds rapidly, and in a few days the birds die from choking.

The embryos of trichinia are taken into the stomach of the pig, no doubt with dirty water and garbage, and those who eat of the flesh of the infested animal die a lingering death from a disease termed Trichinosis. The eggs of the trichinia are about 1-1200th of an inch in size, and a single worm will produce thousands of eggs and young worms every week. Therefore by far the most dangerous contamination to which water is liable is sewage mixed with organic matter. That Thames water is so contaminated is beyond a question. The organic impurities are both dead and living, vegetable and animal. That portion which is dissolved or suspended is the most insidious. Organic matter has a chemical condition wholly distinct from that of water, and its chief characteristic is that it contains nitrogen, and this is greater in amount in animal than in vegetable productions.

The test-tube of the chemist will rightly estimate the per centage of nitrogenous matter in water; but it will not tell us anything about the vegetable and animal organisms which absorb the greater portion of the nitrogenous matter into their bodies. The microscope alone will show this, and also their intimate characteristics; without it, indeed, the significance of such bodies will be missed, or not rightly appreciated. When vegetable matter abounds in water it generally indicates a high degree of impurity; but when animal life abounds to any extent, a much higher degree of impurity will be indicated, because all animal life requires a much larger amount of nitrogenized matter to support existence.*

The absence, however, of organic productions, animal or vegetable, does not afford a certain and reliable proof of the purity of water, because there are other conditions and elements necessary for the development of organic life, as air, light, and warmth. Dissolved impurities derived from decaying or dead animal or vegetable matters may be more dangerous to health than living, and, in the case of the Thames sewage impurities, are frequently found in solution. A contamination of the kind cannot easily be kept out of a river which travels miles through a densely populated country, and the points of entrance of which are almost unknown, for the mouths of sewers below Teddington Lock, even at low water mark, are never uncovered, and of course above the lock their existence, from never being laid bare, must be forgotten. Suspended impurities are also derived from the surface and ground water, a considerable quantity of which is carried off the surface of roads, manured fields, &c., by rains and floods into the bed of the river. These suspended impurities quickly decay, and add considerably to the general mass of dirty, filthy matters. The dissolved impurities furnish the means of growth and existence to low forms of plant life, algæ and fungi, which, together with a certain portion of suspended matters, serve as food for organized animal bodies. I maintain, therefore, that water charged with animal organisms is dangerous, because it contains dissolved and suspended sewage matter, from which animal organisms alone derive their sustenance. It is capable of demonstration that by no power of filtration conducted on a large scale by water companies can any of the dissolved impurities I have named be removed. Of the suspended matters, only the very coarsest portions will be strained off, while the minuter vegetable and animal microscopic forms, spores, seeds, and ova, will all quite easily run through most of the filters in ordinary use.

Almost every gallon of river water distributed to London contains a quantity of spores, seeds, or ova of vegetable and animal organisms, and if a bottle of water is allowed to stand by for a short time, a sediment is thrown down in which a number of creatures will be discovered by the microscope. Such water is undoubtedly unwholesome and dangerous, whether it contains the actual carriers of disease or not. If it contains the elements of disease it is doubly dangerous; if it does not contain matter which may cause disease, it is

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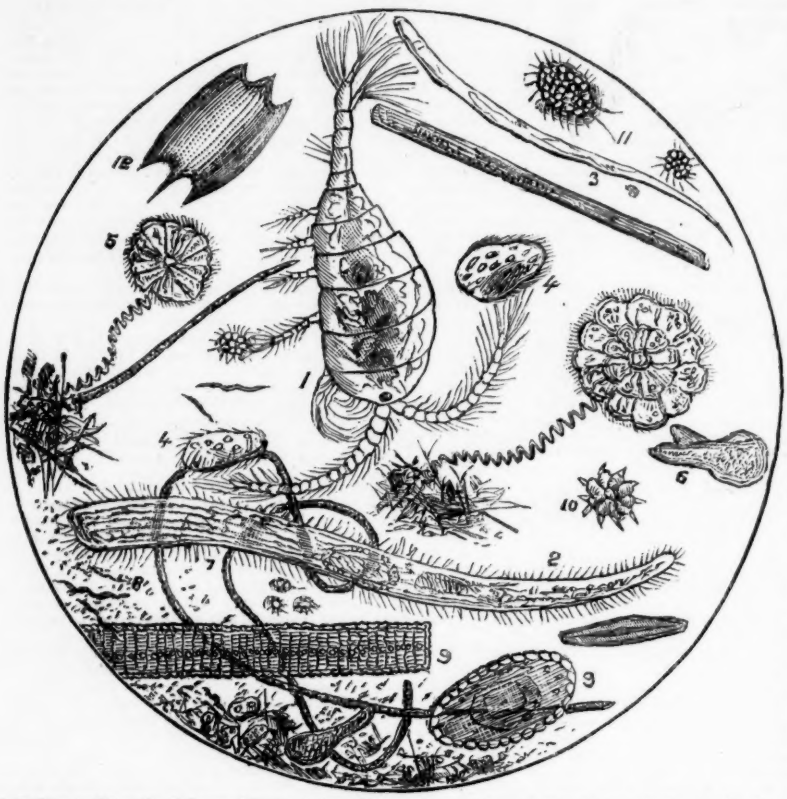
* I may briefly observe, with regard to starchy matters held in suspension, and which form a small portion of the sediment of all river waters, these can scarcely be rightly estimated by a chemical analysis of the water, since it becomes a part of the residual ash, and its importance as an element of contamination is liable to be overlooked. Starch enters largely into the food of all animals; and it is assumed, therefore, that the albumenized granules must have been conveyed into water with animal excreta. This is, then, a serious contamination, and one which can be more readily detected by the microscope than by the test-tube. By the aid of the polarized light, starch grains are beautifully brought into view, and the curious black cross, which seems to split them up, renders these bodies remarkable objects; and I am able to show this under one of the microscopes on the table. It is believed that the household filter will separate such matters and oxidize the albuminoid ammonia in water. But supposing that either the silicated carbon or the magnetic carbide filter exerts a chemical or oxidising, as well as a mechanical effect upon water passed through them, it by no means follows that sewage water can be made innocuous, for, as I have already said, the contagium of diseases, from its extreme minuteness, and from its possessing a specific gravity only very slightly differing from that of the fluid in which it is suspended, will find its way wherever water will pass. It is obvious, therefore, that a far better filtering process is required for the separation of contagium that any yet devised.

still dangerous, because it is the general experience of those who study health and disease, that the drinking of impure water predisposes drinkers to many disorders and diseases, which although they may not be actually produced by the water, enables certain diseases to seize upon its victims, because such persons are what is termed "predisposed"—that is, deteriorated in health by this impure water. For the same reason the liability to illness is increased, so that more persons become sick in a population drinking dirty water than in another population drinking clean and pure water. It is also seen that in a population drinking dirty water more persons die of one and the same sickness than in a population drinking pure water; in other words, the consumption by a population of contaminated water, such as that of the Thames, increases both in sickness and its mortality. I have more particularly dwelt upon the Thames because during three months of last year I made repeated microscopical examinations of the water drawn from the mains and taken from cisterns of the Southwark and Vauxhall Water Company, and in every instance I found the specimens coloured with a considerable dirty sediment, and numbers of organisms. The latter consisted of living and decaying vegetable bodies, as amœbæ, actinophyssol, cercomonas, rotifers, paramœcium, larvæ of filariæ, and fully developed filariæ, resembling the much dreaded trichinæ, when they pierce the tissues to get into the muscles. There were also quantities of fragments of animal and vegetable tissue, starch granules, commonly brought into the river with excrementitious refuse, and myriads of terrible *bacteria*. The latter are looked upon by Mr. Simon as the cause of filth-fever, while the spirillum is a fungus supposed to produce relapsing fever. Some of the bodies are shown in the accompanying drawing.

FIG. 1.



1. Cyclops quadricornis. 2. Larva of filaria. 3. Anguillula. 4. Paramœcium. 5. Colonies of vorticellæ. 6. Amœbæ. 7. Oscillatoria. 8. Bacteria. 9 and 10. Dratomaceæ and desmidaceæ. 11. Stylonichia. 12. Scale of moth.

Very great importance has of late been attached to those very minute organisms, *bacteria*; and medical men have assigned a variety of names to them, as specifically connecting them with various forms of disease, as *Micrococcus diphtheriticus*, *Micrococcus vaccinia*, *Microzymes*, &c. The form of these bodies is either ovoid or staff-shaped, and they assume under the microscope a rapid spiral or undulating motion—an axial rotation of a remarkable character. So very microscopic are they, that no power has yet been made which will show whether they possess structure. Their form only can be seen, and we know they rapidly multiply; their rate of increase appears limited only by the supply of food and the temperature of the body or organ in which they locate themselves. From observation and calculation it has been ascertained that, under favourable circumstances, a single bacterium will produce 16,777,220 individuals every 24 hours. The bodies of these minute living bodies are composed of a peculiar substance, a kind of vegetable cellulose which resists the action of acid and alkalies and great variations of temperature. They live in colonies, protected by a kind of gelatinous covering, for union with them is strength. In certain albuminoid compounds, almost colourless, *bacteria* multiply so rapidly that in a few hours they impart an intense indigo-blue colour to them. These atoms are the active agents in putrefactive changes, and, having gained access to certain internal organs of the human body, the proceed to leaven the whole mass of blood. A drop of putrid water, Ehrenberg calculates, will contain as many *bacteria* as there are human beings on the face of the globe! What, then, must be the size of the ova, or germs, of these organisms? and what mode of filtration can be devised to sift them out of water that contains them? Is it possible to do so? And what does the clumsy process adopted by water companies effect in this way?

I do not wish it to be understood that I have traced typhoid, or dirt-fever, to the presence of these minute organisms, *bacteria*, but Mr. Simon, in his last or supplementary report states, with regard to the production of enteric, or typhoid fever, that a presumption, which has of late been growing more positive and precise, "has received an increase which may be of critical importance in a discovery which seems to give us for the first time an ocular test of the contagion of enteric fever in the discovery of microscopical forms, apparently of the lowest vegetable life, multiplying to innumerable swarms in the intestinal tissues of the sick, penetrating on the one hand from the mucous surface into the general system of the patient, and contributory, on the other hand, with whatever infective power they represent, to the bowel contents which have presently to pass forth from him. This discovery of the microphyte of typhoid fever is the work of Dr. Klein. Adverting then summarily, in an administrative point of view, to the present state of medical knowledge and opinion as to the way in which enteric fever spreads its infection in this country, I would say that it is difficult to conceive, in regard to the causation of disease in a civilized community, any physical picture more loathsome than that which is here suggested; that apparently of all the diseases which are attributable to filth, this, as an administrative scandal, may be proclaimed as the very type and quintessence, that although sometimes by covert processes, which I will hereafter explain, yet far oftener in the most glaring way, it apparently has an invariable source, as that which of filth is the filthiest; that apparently its infection runs its course as with successive inoculations from man to man, by instrumentality of the molecules of excrement which man's filthiness lets mingle in his air and food and water."* I am able to show you what these bodies, *bacteria*, are like, under one of the microscopes which Mr. Browning has been good enough to place on the table.

It is said that horses and cattle will, with impunity, drink river and other contaminated water, and indeed even prefer it; but more recently it has been discovered, in common with human beings, they suffer from such cause. A highly malignant and contagious disease, "splenic fever," or "milzbrand," distinguished by the extreme rapidity of its course and fatal consequences, attacks horses and other animals. The chief characteristic of the fever is the presence of immense numbers of *bacteria* in the blood, with marked peculiarities, which are regarded as specific. The disease is localized in the internal organs, the stomach, &c., and after death rod-like bodies are found in these situations, as in the human being. In the cattle plague also the blood of the animals swarms with these extremely minute bodies, which are univerally present in the textures and juices, and are therefore believed to be the *contagium* of the disease; and, as Mr. Simon remarks, we seem to have obtained some positive knowledge "with regard to the respective *contagium* and respective morbid processes of typhoid fever, diphtheria, erysipelas, relapsing fever, and the splenic fever of veterinary practice." It has also been satisfactorily shown that in the blood and vital organs of persons who die by septic poisoning, *bacteria* abound and plug up the smaller vessels; and, therefore, if not actually proved to be the cause of death, they are evidently active agents in the disease. It is my belief, however, that the germs of fevers will ultimately be proved to be far more minute than *bacteria*, and for this reason, the very smallest dose of sewage, liquid organisms—a homœopathic dose—may be quite sufficient to destroy life.

It will scarcely be denied that the water supply of the metropolis, compared with many other towns that derive a supply from subterranean sources, stands low in the scale of purity and wholesomeness, and it is quite certain that no remedy for existing evils will be effectual or really beneficial that stops short of providing a new source of supply. The question then arises, to whom should we look to provide a remedy? The Board of Works has already wasted thousands of pounds to find one, and in the preparation of water bills, since consigned to the place of good intentions. The President of the Local Government Board, when appealed to in and out of the House of Commons, refused to pledge himself on the subject, and intimates that the evil day must be put off by another Royal Commission extending over years of precious time, for it is not yet forgotten that the Royal Commission of 1866 disappointed hopes of the public. This inquiry into the means of obtaining additional supplies of unpolluted and wholesome water for the metropolis and other large towns was a miserable failure, for, after an investigation extending over a period of two and a half years, no good came of it. Indeed, the report appears to have been made in the interest of water companies rather than that of the public. In one part of the report the commissioners state, "that with living microscopic organisms chemistry is unable to deal, and, therefore, other modes of examination are needed," but they persistently refused to have recourse to "other modes of examination," and altogether ignored the aid of the microscope, which would have assisted them in coming to a right conclusion on the character and wholesomeness of the water supply of towns; consequently, much of the report, founded as it is upon insufficient data, is very properly regarded as worthless, and as containing grave inaccuracies.†

The great evils of the present water supply will not be abated by any half measures, or by a Royal Commission. Nothing short of having recourse to subterranean stores, Artesian wells, sunk into the chalk or sandstone far out of the reach of sewage contamination, will, in my opinion, afford the shadow of a remedy. The large supplies of water stored up in the deepest recesses of the earth, as pointed out by Mr. Homersham, in a valuable and interesting lecture delivered in this room 20 years ago, will alone remove the evils under which we labour. Such water stores are absolutely pure and brilliant. They are entirely free from all suspended matters, and from decaying organic substances, and fæcal refuse. Neither spores, seeds, fungi, ova, or the larvæ of animals can possibly penetrate to the deep recesses of the earth. Deep well water contains probably the inorganic products of the thunderstorm of a century or more ago—a little lime dissolved out of the chalk as it passes through the rock, a little chloride of sodium washed out of the sea ages gone by and deposited in the soil, but it contains no ammonia in organic combination, and no albumenoid ammonia. It contains what we prefer, fixed air, and imparts a spark-

* "Supplementary Report to the Local Government Board on some Recent Inquiries under the Public Health Act, 1858." New series. No. 2, page 14.

† It is a subject of congratulation to find that since my paper was put into the printer's hands the Government has shown signs of a desire to grapple with a portion of the evils of river pollution. The Marquis of Salisbury has introduced a bill into the House of Lords on the subject, and in doing so he said, "The grievance of the present state of our rivers is a real one, and the necessity of applying a remedy is a pressing one." He offered to the House a few instances of the alarming amount of river pollution—such as, "the Clyde at Glasgow, the stench from which as you pass along produces sickness." A clergyman living near a stream which passes St. Helen's, complains that the stench is not only offensive out of doors, but penetrates to the rooms of his house, and turns the kitchen copper utensils to a blue colour. The river at Manchester is in an execrable condition, and the Mersey is as bad as the Calder, with which a manufacturer wrote a letter as legible as if he had used ink." The Calder receives the sewage of Wakefield, nevertheless the water company draws its supply about a mile below the point where the larger part of the sewage enters the river. It must be noticed also that the Calder, although navigable, is as narrow as a canal as it passes Wakefield, and in addition to sewage it is the receptacle of the refuse of many manufacturing works. Last year I made several examinations of the Wakefield water, and found them exceedingly bad and abounding in living organisms. The accompanying drawing shows the appearance of a few drops of Wakefield water under the microscope. That such sewage could not only be rendered innocuous, but also be made a source of wealth to the country, has, I believe been proved, and therefore it is high time that the Legislature should preserve to all Her Majesty's subjects the right of using the water of our rivers, while no one shall be permitted to foul and poison them for purposes of his own, or under any circumstances.

ling briskness to the water, carbonic acid and air. It is, therefore, absolutely safe to drink, and it is wholesome, and fit for all purpose of life, domestic and dietetic.

FIG. 2.

MICROSCOPICAL DRAWING OF THE SEDIMENT OF WAKEFIELD WATER, Magnified from 50 to 250 diameters.

1. Young of Daphnia. 2. Chilodon. 3. Paramœcium. 4. Acineria incurvata. 5. Paranema globulosa. 6. Cercomonas. 7. A cluster of Actinophrys sol. 8. and 9. Amœbæ. 10. Protococcus pluvialis. 11. Diatoms varios. 12. Desmids various. 13. Confervæ. 14. Spores of fungus. 15. Fragments of vegetable tissue. 16. Amœbæ diffluens. 17. Cyclops quadricornis. 18. Cypris. 19. Anguillula fluviatilis.

The CHAIRMAN said he was sure the meeting had been greatly interested in the paper just read. For himself, he did not intend to take up much time by any remarks upon it, further than to say that though he had listened with deep attention, and had been much pleased with some of the statements, he was bound, as an honest man, to state that with a good many of Mr. Hogg's remarks he could not possibly agree. It would be too long a story if he were to express all his views upon the subject, and, therefore, he would only say that if the animalcule and fungoid matters of which they had heard, produced such diseases as had been referred to, it was perfectly astonishing that the human family still remained on the face of the globe. Moreover, he could not, by possibility, see how they were to continue to live if they could not by some process get rid of the contamination complained of. The deep well water might be pure when it first came up, but, as the lecturer well knew, the purer the water, the more rapidly it imbibed impurity. It could not be exposed to the atmosphere long, before it took up those spores which were always floating about in myriads, and which were taken into the human lungs at every inspiration. Life, therefore, must after all be endured with some of these contingencies. Now, with regard to the contaminated waters of this country, the comparison ought to be fairly stated. Take the health of towns, the supplies of water to which, they were told, were of an unexceptional character, and compare it with that of towns where the supply was said to be much contaminated. In Glasgow, for example, drawing its water supply from Loch Katrine, what was the state of things? Why, in Glasgow, at the present moment, typhus fever abounded. In Birmingham, no doubt, disease existed in excess; but, so far as he knew, cholera had never raged in that town. Even when at Birmingham they were drinking the water which had drained down from Bilston, a town which was decimated by the cholera, there were no cases of suffering from that disease. With regard to India, he agreed with the lecturer that the terrible diseases referred to had prevailed there, and that there was every reason to believe they were propagated by the foul water drunk by the inhabitants. But in England, people had no conception of the state of the water drunk in India. Why, the water of the river Thames below London Bridge, after receiving the contents of all the sewers of the metropolis, would be purer than the water drunk by the masses of the population of India. The waters they obtained there from shallow wells and rivers, in the dry season, were fearfully contaminated. The sacred river, the Ganges, was filled with human bodies, by thousands. He (the chairman), as a member of the Army Sanitary Committee, had had this subject prominently before him, and he might state that in one of our great Indian provinces an account was prepared, and it was shown that 1700 carcases of human beings were taken out of the sources of water supply in one year. Indeed, one of the readiest means of committing suicide was to jump into a tank or down a well. One of these sources of supply was so foul that when it came to be examined, bushels of human bones were removed from it. And the inhabitants of the district for years had drunk that water! It was not, therefore, to be wondered at that some of those frightful forms of disease should prevail which had been mentioned—that the people should suffer from the Delhi sore and various entozoic forms of disease. He (the chairman) was no advocate for impure water—far from it; he would say, let them have pure water by every means; but he contended that they ought not to set up some fearful bugbear and bogey, which could only serve the purpose of unnecessarily frightening people. With regard to soft water Sir John Pringle, in his account of the invasion of the Highlands, stated that his men became utterly disorganized by drinking the pure water of the lakes, which brought on diarrhœa and similar diseases. He (the chairman) in his enthusiasm for pure water, when he went into the Highlands some 20 years ago, took to drinking a pint of this water before breakfast, the result being that it brought on spasms. He thought people did not pay sufficient attention to the consequence of a change of water. If a person in delicate health, who was in the habit of drinking a particular kind of water, made a change from one district to another, it might be as much as his life was worth.

Dr. BARTLETT remarked that, after the careful and exhaustive paper read by Mr. Hogg, he would not attempt for one moment to criticize or go into the details of the matters touched upon, but briefly remark upon one or two points that had occurred to him, which he fancied the lecturer had not time or space to dwell upon. Mr. Hogg had commenced by dividing his subject admirably into two heads—river pollution and the supply of water to towns, under the former stating the various sources of pollution, which were also shown on the admirable map of Dr. Frankland. And he proceeded to point attention to the matters which flowed into our rivers and polluted them. These refuse matters consisted mainly of town drainage, chemical waste, the drainage from mines, and fibrous material. With regard to the importance of chemical pollution, he might mention that he had recently analyzed the refuse from a print-works in the neighbourhood of Manchester, and found that from one to four tons of arsenious compounds per diem were flowing into one small stream. Nothing could exaggerate the evil of such a state of things. The pollution of rivers was, perhaps, the least dangerous form in which the evils of town drainage manifested itself, because proper means might be taken to render the sewers themselves harmless; but the evil was very great in the case of ponds, canals, and receptacles of various kinds, in which there was no flow through and no opportunity for the oxidizing process to go on, which they knew did exist. He had had occasion to examine the water at the Regent's Canal, into which the drainage from the Zoological Gardens, a large number of houses, and some stables, was permitted to flow; and he found that, instead of there being any current of water, it was customary in dry seasons even to pump back the water used at the locks, so that none might be lost, and it was often very offensive indeed. Water of this sort, even if not used for drinking purposes, became highly dangerous when the canal became low in hot weather, and the banks, covered with many noxious matters, were exposed to putrefaction in the open air. The emanations from such ponds were the source of terrible diseases, and this point must not be lost sight of, but should be looked into with great care. But, when they came to the question of drinking water being taken from them, there was positive evidence that the specific poison referred to would set up disease in persons at all susceptible to their action; and, although it must be admitted that the vast majority of persons were not susceptible to these affections, this was no argument in favour of their use. The lecturer spoke of chlorine in paper makers refuse killing fishes. That undoubtedly was the fact, and the water taken from the spot was wholly unfit for drinking or domestic purposes. But he (Dr. Bartlett) had had this circumstance before him, that though close to the Zoological Gardens, the water of the Regent's Canal was in the very worst state, containing all the impurities spoken of that evening, yet when that water got down to Limehouse Hole, it was found that some of the refuse poured into it, in its passage past certain manufactories and gas-works, had had a most decidedly antiseptic effect upon it; and an analytical and microscopic examination showed that it was far purer and more wholesome for drinking purposes than it had previously been. They were bound, therefore, to take into consideration the effects of these bye-products, however disagreeable they might be in themselves. With regard to deep wells, he would point out a source of danger in connexion with them. He had had samples of well water before him, which were poisonous on account of the quantity of lead held by them, derived from the action of the mineral ingredients on the lead-pipes through which the water had been conveyed. It might be said that this difficulty would be removed by using gutta-percha or iron pipes; but the former rapidly wore out, and the latter rusted away. In his own house at Norwood he had suffered from the badness of the water supplied, on one occasion whne, from a defect in the pipes, there was a direct contamination from the sewer. He could not agree with what he had understood Mr. Hogg to say, that by the filtration of water containing albumenoid and organic matters productive of injurious influences there would be no great diminution in the amount of these poisonous matters, because he knew of more than one filter which did oxidize and improve the water to a very great extent, and did, in fact, remove everything noxious from ordinary water, unless it were specific germs of disease which were so minute that they could not be detected either before or after filtration, and as to which, therefore, it was impossible to speak. From practical experience he believed that by a proper system of filtration, not perhaps in the water company's reservoirs, but in the consumers houses, they might obtain a great alleviation of the evils of which they had so much to complain.

Mr. A. SCOTT said the lecturer had alluded to the great increase in certain classes of disease, such as diarrhœa, dysentery, and cholera, during the last 50 years, and it was always well in such cases to give the exact figures. He found from the Registrar-General's returns that for the five years ending 1842 the average number of deaths per million per annum from diarrhœa, dysentery, and cholera was 298; but in the five years ending 1871 the average number per million had increased to 1200. It might be that in the earlier years the returns were not quite so exact, but that would not account for so great a difference, and one naturally, therefore, was led to consider what could be the cause of such a change. What alterations in our habits of life could there be to cause such an increase of deaths? They had heard of the danger of excremental pollution, and they had one great fact staring them in the face that since 1842 there had been a general introduction of the water carriage of sewage in a large part of the country. It would not be true to say that this water carriage had been *the* cause of the increase in these diseases, but that it had been one of the causes he felt there could be little doubt. The fact was, it was due to the want of attention in the disposal of excremental matters. The chairman was rather of opinion that the lecturer had made too much of excremental pollution and sewer gases. It was very interesting, therefore, if they could find a town where the water supply was derived from the same source, but where there were two separate systems of the disposal of excremental matters. He referred to Edinburgh. There, in the old portion of the town, where, from the character of the houses, it was not practicable to introduce modern appliances, typhoid and diphtheria were comparatively unknown, whilst in the new and fashionable town, where the houses were fitted with all the conveniences of modern times, these diseases were never absent. The question of river pollution was now interesting the public greatly, and it was approached on two sides. The general public thought principally of the beauty of the stream; while persons like the lecturer thought mainly of the effect on the public health. The lecturer, moreover, contended that they could not, as far as science went, destroy the germs of disease when once the pollution arose; that, in fact, as a rule, the mischief was done before any methods could be resorted to. It seemed to him that the proper course for legislation to take should be to deal, not with the rivers themselves, but with the source of the pollution flowing into the rivers. A strong hand had lately been put upon disease, so far as its repression in cattle was concerned. Why not have the same thing with regard to our rivers? Was it not possible, by legal means, to insist that receptacles

for excremental matters should be so constructed that they should not pollute the air, the soil, or the streams? In all matters affecting the public health nothing should be left to private control.

Professor WANKLYN said the lecturer, towards the close of his paper, made one remark in which he completely coincided—viz., that deep spring waters were absolutely free from organic matters. In many instances they were free from all traces of albumenoid ammonia—*i. e.*, of organic matter capable of yielding ammonia by oxidation. But when they inquired how it came to pass that such was the case, the answer was that they had been filtered, and this filtration performed by nature could even be imitated upon a small scale. He had a filter, into which he could put Thames water, and it would come out like the water supplied by the West Middlesex Company. By filtering it a second time, it would resemble that supplied by the Kent Company; and by repeating the process a third time, you could get water absolutely pure, and free from all nitrogenous organic matter. It was quite a mistake to suppose that the large filters used by the water companies had only a mechanical action; they had a powerful chemical action also. The organic matter adhered to the material of the filter, and, by-and-by the oxygen dissolved in the water oxidized it. Indeed, although it would be rather a cumbrous and tedious process, he could actually perform analyses by the use of a filter, as well as by oxidizing materials in the presence of caustic potash. Such being the case, it must be obvious that polluted river water, if allowed to subside, and then filtered, could be made sufficiently pure for all practical purposes. Some years ago the late Dr. Chapman, Mr. Smith, and himself, examined the water supplies all over the country, and they found almost every description of water, when fairly filtered, soon obtained a high state of purity. The water which the great Thames companies supplied when properly filtered, was quite as free from organic matter as the water in Glasgow; in fact, it was a little better. This was an important point to keep in view, or else the country might spend millions of money in getting water from deep wells, when it could be obtained sufficiently good from any river. Years ago he insisted on the purity of deep spring water, but it was often so impregnated with mineral matter as to be very troublesome for continual use. He had recently examined some deep spring water, which it was proposed to supply to a large town; it was beautifully pure, but it contained 25 grains of ordinary sulphate of magnesium per gallon; and he was happy to say the scheme was not sanctioned by Parliament. It was much to be desired that, through no kind of panic, sources of supply of this description should be taken, because, while they could deal with the organic materials in water, they could not deal with those which were inorganic. In dealing with water supplies on a large scale, the main inquiry should be as to the organic matters, for they were comparatively trivial, and, with a little extra filtration, they could be all got rid of.

Mr. HOMERSHAM said he had to express his entire dissent from everything that had fallen from the last speaker. There was no difficulty in taking bicarbonate of lime out of water; it was constantly taken out at many works. But when Professor Wanklyn asserted that the organic matter could be dealt with, he (Mr. Homersham) utterly denied it, and asked the professor to give some account in one of the scientific journals of the process by which he proposed to do it. Natural filtration and the filtration practised by the water companies were totally different things. The water that fell on the chalk hills percolated through the pores for 300 or 500 feet in the course of half a century, while every change of barometrical pressure exposed it to the oxidizing action of the air. In this way it became entirely free from organic matter, and though no doubt spring water often contained mineral matter, this could be removed by an easy process, so that the water could be delivered with only 2½° or 3° of hardness. But in the case of water containing the living organisms referred to, he confessed that he knew of no system by which they could be got rid of. The filtration process, as practised by the water companies, was one of the most horrible things to be conceived. The filter-bed was formed of gravel and course river sand, for if the sand were too fine the water would not run through it; in passing Thames water through, there was arrested on the surface of the sand portions of undigested food, fæcal matter, leaves and blossoms of trees, and all sorts of things, according to the season. In the summer time when the temperature was 65° or 70°, these matters resting on the sand became further decomposed, and the fresh water let into the beds had to pass through a stratum of decomposing organic matter 4 feet 6 inches deep, the temperature being just that which would allow these matters to be taken up in solution. He contended that the water thus became worse after passing through the filters than it was before. He had known men at the Grand Junction Works who would not drink the filtered water as it came direct from the river. These matters remained on the top of the beds till the sand got choked up. They were then removed, and with them about half an inch of sand; and, during the operation of removal, the men were obliged to be supplied with gin to counteract the effects of the impurities. How was it possible to compare such filtration with the process of natural filtration?

The CHAIRMAN said he would just remind Mr. Homersham that the water supplied by the London companies was examined and reported upon each month by two most eminent chemists, and those reports, which were published in the papers, showed that there was a very visible and calculable change effected in the waters by the system of filtration in operation. Professor Wanklyn spoke not of removing the carbonate of lime, but of the sulphates, and Mr. Homersham must know that though he could take out the bicarbonate of lime, he could not touch the sulphate.

Mr. HOGG, in reply, said he quite agreed with the chairman that they had much to fear, if all were true which was stated of the water in the admirable reports to which he had referred, and which he had attentively read and considered. That greater evils did not result was attributable to the fact that the greater portion of water which was drunk was in the shape of tea or coffee, or after it had been boiled, so as to destroy the various ingredients; but amongst the masses of the poor, who had no means of boiling it, a large quantity was drunk just as it came from the water companies, and it was amongst these that the large number of deaths occurred. The case of Lewes was exceptional; but it showed that when once water became contaminated, the poor and the rich were equally liable to be affected. The mortality of Birmingham, Glasgow, and many other large towns was much higher than London, which he attributed in part to the water supply. Referring to a statement by the chairman, he would observe that at the date of Sir J. Pringle's expedition, very little was known of water, but with regard to India he had lately received a letter from an officer, stating that his troops were constantly suffering from diarrhœa, dysentery, and similar diseases, when on the march, from drinking impure water, and that the commanding officer, who was a water drinker, had been several times attacked with cholera. There was no doubt that several of the filters in use had a chemical action, and the silicated filter, which it was said would separate contamination of lead, was a good one, but it was too porous, and would therefore allow the passage of *bacteria*. Dr. Frankland had recently stated that the filtration as ordinarily practised by the water companies was nearly valueless, and that the only process which could be depended on was intermittent filtration. It appeared that a filter became choked in 30 hours; so that unless the action was discontinued, and the surface exposed to air, it was really worthless. This was ordinarily practised in domestic filters, and probably accounted for their success, and it was a most important fact to be kept in mind.

The CHAIRMAN said the process of filtration as practised by the London water companies was intermittent. Some of them had been pinched for room, but they had been lately extending their filtering areas, and most of them had now a surplus sufficient to allow of intermittent filtration; the others soon would have.

A vote of thanks having been given to Mr. Hogg, the proceedings terminated.

METROPOLIS GAS SUPPLY.

The Annual Report of the Metropolitan Board of Works for the year 1874 has just been published. From it we make the following extracts, in reference to the policy of the board on the gas question:—

The gas supply of the metropolis is a subject which has during the past year occupied much of the board's attention, and to which the attention of the public also has been directed in an unusual degree. This has been mainly owing to the substantial increase of price to which most of the gas companies have subjected their consumers during the two years or more which have elapsed since the noticeable augmentation of the price of coal. The tendency for many years previous had been towards a reduction of the price at which gas could be supplied. The companies had nearly all been in the enjoyment of the maximum rates of dividend allowed to them by Parliament, the rate being in most cases 10 per cent., and it was not contemplated by the public that the companies would, as soon as they found themselves in the position of not being able in the adverse circumstances of trade to divide their accustomed maximum profits, transfer the whole of the disadvantage to the consumers, and advance the price of gas to such an extent as to secure the continuance of dividends at the maximum rate. Such, however, was the course which most of the companies adopted.

The companies, whose maximum prices are fixed by the Metropolis Gas Act of 1860, are able, without any public inquiry or representation of the interests of consumers, to raise their rates to 4s. 6d. per 1000 cubic feet, and, accordingly, several of the companies which had previously been charging 3s. 9d. and 4s. did, in 1873 or 1874, advance the price to 4s. 6d. Three of the metropolitan companies, however, were subjected to further restrictions in point of price and other matters by Acts passed in the years 1868 and 1869; The Gaslight and Coke Company and the Imperial Gas Company being limited to 3s. 9d., and the South Metropolitan Company to 3s. 6d. per 1000 feet, unless they are able to satisfy commissioners, whom the Board of Trade is empowered to appoint, that they are unable, with due care and management, to secure with gas sold at such prices a dividend at the maximum rate.

In January, 1873, The Gaslight and Coke Company applied to the Board of Trade for authority to charge an increased price, and the commissioners appointed to inquire into the necessity for it, having heard the company on the one side, and this board and the Corporation of London on behalf of the consumers on the other, fixed 4s. 4d. as the price of common gas for the year 1873, being an increase of 7d. per 1000 feet, and allowed a proportionate increase in the price of cannel gas.

In January, 1874, the same company again came forward with a proposal for a further advance of price to 5s. 2d., and an investigation took place before the same commissioners, which resulted in the price being fixed for the year 1874 at 5s. per 1000 cubic feet, being an advance of 8d. per 1000 feet on the price of the previous year, and on that of the year 1872 an advance of 1s. 3d., or 33 per cent. above the price named in the Act of Parliament.

The Imperial Gas Company, at the same time, made a request to the Board of Trade for an increase of price, and, after an inquiry by the same three commissioners, before whom the board appeared by counsel to represent the interests of the consumers, the price for the year 1874 was fixed at 4s. 8d. per 1000 cubic feet, being an advance of 11d. on the price previously charged. It appeared to the board that the management of this company's affairs was seriously to be impugned, as exhibiting an absence of that care and prudence which the company was bound to exercise. There seemed reason to believe that there had been a wasteful expenditure of capital upon new works, and that the money had been raised at rates of interest needlessly high, and that in these ways undue burdens were imposed upon the consumers. The board urged that the commissioners should inquire into the mode in which capital had been raised and expended, and that evidence of want of proper care and prudence in these respects should be taken as disentitling the company to transfer the burden of the consequences to the consumers. The commissioners were of opinion that the provisions of the Act under which they were appointed did not authorize them to extend the inquiry so far, but, for the satisfaction of all parties, they submitted this and other questions which arose, for the consideration of the law officers of the Crown, who confirmed the commissioners opinion. They were advised that, for the purpose of the inquiry, the whole of the capital raised by the company must be assumed to have been duly raised, and their functions were, therefore, limited to ascertaining what price it was necessary for the company to charge to enable it, with due care and management, to pay the maximum dividends and interest on the share and loan capital raised, and to make up the reserve-fund to the full amount named in the Act of 1869. The result was, as above stated, to increase the price for the year from 3s. 9d. to 4s. 8d. per 1000 cubic feet.

The board felt that this limitation of the scope of the inquiry seriously lessened the protection which the Acts of 1868 and 1869 had been thought to afford to the consumers against extravagance and wasteful expenditure by the companies. It seemed clear that, if the capital which the Legislature empowered the companies to raise were to be raised and expended by them as they thought fit, without any control or inquiry from without, and if, whenever they were unable, with the prices named in their Acts, to pay the maximum rates of dividend, they had only to satisfy the Board of Trade Commissioners that this was so, to have the price at once advanced to the requisite extent, the consumers were really in no better position, in point of price, than they were under the Metropolis Gas Act of 1860. Indeed, as a matter of fact, The Gaslight and Coke Company and the Imperial Gas Company, the two largest gas companies of the metropolis, have, under what has been generally looked upon as the improved gas legislation of 1868 and 1869, been charging for gas, during the past year, prices higher than any other gas company in the metropolis.

The dissatisfaction of the public with the companies proceedings has been great and widespread. It has been manifested by public meetings, action in the local boards, deputations to the Board of Trade, and numerous appeals to this board to make some effort to bring about a better state of things. The board, feeling with the public that the arrangement was not satisfactory which enabled companies, possessing a monopoly for the supply of gas, to call upon their consumers to make good, by paying an increased price, whatever losses or reduction of profits the former might meet with from adverse circumstances of trade, resolved to take the matter into serious consideration, and to see what could be done towards the establishment of a more equitable system.

It should be stated that the board has always felt itself under some difficulty as regards the initiation of any measure for the reform of the gas arrangements of the metropolis, and for this reason. A select committee of the House of Commons, in the year 1867, made a long and exhaustive inquiry into the subject, and came to the conclusion that the Metropolis Gas Act of 1860, and the arrangements which it sanctioned, had been eminently favourable to the companies, while the interests of the consumers had been inadequately protected; and that the latter were entitled to greater advantages and to a more efficient control over the companies proceedings. The Board of Trade, as promoting the bill then before the committee, together with this board and the Corporation of London, were agreed in seeking to establish more equitable conditions, but the committee declined to impose them upon the companies against their consent, on the ground that "a compulsory and unconditional interference with the prices already conceded to the producer is not the weapon by which Parliament is accustomed to secure the rights of the consumer." The committee pointed out that it would always be in the power of the Legislature to prescribe terms of regulation as each company came before it to apply for new powers,

but that it would not be just to the consumer to leave him to the casualties of this mode of treatment; and that, if the companies declined to submit to general regulations, the proper remedy would be for Parliament to concede to this board and the Corporation of London the power of supplying their respective districts with gas, independently of the companies.

The position, therefore, in which the question was left by the report of the select committee was this—that there was reason to doubt whether the Legislature would impose on the companies new regulations and a stricter control in the interest of the consumers, unless the companies either consented thereto or themselves applied to Parliament for further powers and privileges; and that the only sure way of securing to the consumers the benefit to which they were entitled was for the board and the corporation to obtain power to make and supply gas themselves. In considering, therefore, the course to be taken on the present occasion, the board had necessarily to be guided to a great extent by the conclusions of the select committee of 1867, and from these it appeared that it would be unwise to go before Parliament with any proposal for a reform of the gas arrangements of the metropolis, without being prepared with a scheme for an independent supply. At the same time the board did not wish to tie itself to this plan alone, and it was accordingly determined, after much consideration, to submit with it two other alternative plans—one to enable the board and the corporation to acquire by purchase the companies undertakings, and the other to subject all the metropolitan gas companies to new and improved regulations. This course was decided on after consultation with the City Corporation, it being felt by both the corporation and the board that, as the interests of the citizens were in this matter identical with those of the inhabitants of the other parts of the metropolis, the joint action of the two bodies was on every ground to be desired. Notice was accordingly given in November last of the intention of the corporation and the board to introduce three separate bills, and two of these—viz., that to enable the board and the corporation to acquire the undertakings of the gas companies in the metropolis, and that to empower them to make and supply gas independently of the companies—being of the nature of private bills, have been prepared and deposited, with plans, books of reference, &c., and all other necessary measures have been taken as required by the Standing Orders of Parliament. With respect to the third bill, as this will be of the nature of a public measure as an amendment of the Metropolis Gas Act of 1860, the preliminaries required in the case of private bills were not necessary. It can be introduced at any period of the session, and it has not yet been decided what its provisions shall be. The board and the corporation will give their attention to this early in the new year.

The following are the main provisions of the bill for the acquisition of the companies undertakings. It is proposed that the board may at any time within one year after the passing of the Act, by notice in writing, require any company to sell its undertaking, and any company so required is to sell its undertaking to the board. The companies whose undertakings may be purchased are all those whose works are within the metropolitan area. With respect to such companies as have their works outside the metropolitan area, but which supply gas partly within the area, it is proposed that the board shall arrange to take over from them such portions of their districts as may be within the metropolis. The basis of the terms of purchase is to be the average market value of the shares during the three years preceding Oct. 1, 1874, and the purchase-money is to be raised by the creation of an irredeemable stock, with a small annual sinking-fund. The board and the corporation will have power to raise such further capital as may be required from time to time for new works. The minimum illuminating power of the gas is to be 16 candles, when tested by the burner now prescribed by the gas referees. The price charged is to be as low as circumstances will admit, but no maximum price is named, and the profits, after paying all charges and interest, and providing for a reserve-fund not exceeding 4 per cent. on the total nominal amount of stock, are to be carried, one half to the sinking-fund to be formed in connexion with the said stock, and one half to the board's Consolidated Loans Fund, which is applicable to the payment of interest on and the redemption of the principal of the board's general debt. The bill contains a clause enabling the board and the corporation to enter into agreements between themselves as regards the supply of gas to the City, and also a clause empowering them to delegate to committees of their respective bodies the carrying out of the provisions of the Act and the management of the supply.

The second bill, which is to empower the board and the corporation to establish gas-works of their own, and to make and supply gas independently of the companies, contains the necessary provisions for this purpose. Many of the clauses are of necessity similar to those contained in the first bill, and as under this bill, if passed, the board and the corporation would be in the position of competitors with the companies for the supply of gas, they have thought it right to propose to place themselves under the same conditions, in the interest of the consumers, as those to which the companies are subject. This second bill will be brought forward only in the event of the companies refusing to accede to the terms of purchase which the select committee of the House of Commons may think reasonable. By submitting the three bills to Parliament, every mode of dealing with the subject will be brought under consideration, and it will be for the Legislature to decide, after investigation of their respective merits, which of the three alternatives shall be adopted. No effort will be spared by the board in promoting a thorough investigation, and it is hoped that the result will be, if not to remove, at all event to lessen, the grievances which the consumers of gas and the ratepayers generally feel that they suffer from the present arrangements regulating the supply of gas by the companies.

Testing of Gas.

The gas supplied by The Gaslight and Coke Company, the Imperial Gas Company, and the South Metropolitan Gas Company, has been regularly tested throughout the past year by the board's officers, and the illuminating power and purity have been found to fully satisfy the requirements of the Act of Parliament and the prescriptions of the gas referees, except on a very few occasions, and then the defects were certified by the chief gas examiner to be due to accidental causes, for which the companies could not properly be held responsible.

The Imperial Gas Company having begun this year to make gas at its large new works at Bromley-by-Bow, a place for testing the gas was named by the referees, and an officer was appointed by the board to discharge the duty. The testing-place is in Bruce Terrace, Bow. As the Bromley works are quite on the outskirts of the metropolis, so that there is no obstacle to the free use of any appliances for the removal of sulphur from the gas, the company is required by the referees to keep the quantity of sulphur in the gas made there below 20 grains in 100 cubic feet, as is the case with The Gaslight and Coke Company at its Beckton and Bow Common works. There has been lately a further advance in the direction of freedom from sulphur at the other works of the three companies whose gas is tested by the board. In the winter half year of 1873-4 the amount of sulphur allowed to be present in the gas, which in the summer had been 25 grains in 100 feet, was increased to 30 grains, on account of the much greater demand made upon the companies powers during the winter. In the summer the maximum was again reduced to 25 grains, and on the 1st of October the referees announced that this maximum was to be adhered to through the winter as well as the summer. This is a great advance when compared with the quantity of sulphur found in the gas three or four years ago, when it was not unusual to find 40, and sometimes as much as 50 grains per 100 feet in the gas made at some of the works.

The maximum quantity of ammonia allowed to be present in gas is 2½ grains per 100 feet, and this quantity is never exceeded. Often the gas is altogether free from ammonia, and the average of the whole is less than 1 grain.

Mention was made in the board's report of 1872 of a question raised by the Imperial Gas Company, whether the cost of the test solutions and other chemicals used by the examiners in testing the gas was a charge upon the companies whose gas was tested. For the decision of the question it was agreed to submit a case to the Court of Queen's Bench; the case was argued in May last, and the decision of the court was in favour of the company's view. The cost of the materials referred to is, therefore, borne by the board. It was at the same time decided by the court that the expense of cleaning the testing-places and keeping them in order was properly a charge upon the companies.

Testing of Gas-Meters.

Under the Act regulating the measures to be used for the sale of gas, the board is required to have all gas-meters made for use in the metropolis tested by inspectors employed for that purpose, to ensure the public being always supplied with accurate measuring instruments. A small charge is made for each meter tested, according to a scale fixed by the Act. There are three testing-places, two on the north and one on the south side of the Thames, and at each place is an inspector with a staff of assistants. The number of meters tested during the year 1874 was 73,315, and the amount of the fees received or receivable in respect thereof £2566 9s. The expenses of carrying out the provisions of the Act were about £2000.

UNJUST ACCUSATIONS AGAINST THE METROPOLITAN GAS COMPANIES, AND THEIR REFUTATION.

In *The Times* of the 19th inst., the first of the annexed series of letters was published, the writer of the money article in *The Times* prefacing it with the following remarks:—

"The subjoined letter calls attention to the position of the metropolitan gas companies. Whether the public are right in assuming that Parliament has guaranteed to these companies a 'virtual monopoly' or not does not matter, for they have that monopoly in reality, and are, probably, more exempt from control in their privileges than any monopolists now existing. Public opinion—the only authority they are amenable to—reacts on their conduct, but only slowly and indirectly, and over their accounts we are not aware that there is any efficient supervision. They impose what conditions they please on their customers, and change their terms also pretty much when they please. Some companies, for example, take a substantial deposit from intending customers, as preliminary to all business transactions, which they retain, without paying any interest on it during the whole period over which gas is supplied. It would be interesting to know where the earnings of such money, as well as the capital amount of it possessed by each company, are exhibited in their balance-sheets."

"Sir,—Now that the Metropolitan Gas Bill has passed its second reading in the House of Commons, and gone into committee, it is of importance for the public attention to be directed to two points in connexion with the subject, on which much misapprehension still prevails in many quarters.

"Firstly, it is supposed by some persons that Parliament has, in past years, guaranteed to the gas companies a virtual monopoly in their several districts, and a dividend of 10 per cent. on capital, whereas the Act makes 10 per cent. the maximum for dividends, and merely declares that no other parties shall supply gas to the respective districts, 'unless authorized by Parliament to do so.' Thus Parliament is in no way committed to any engagement to sustain the companies in their present position.

"Secondly, as to capital. For years the metropolitan gas companies have been increasing their capital until it now amounts to an aggregate of between 10 and 12 millions sterling. It is an easy and profitable process to borrow money at 4 per cent., and then constitute the loan into capital to which 10 per cent. dividends may be appropriated, virtually at the expense of the public, the consumers. Furthermore, most of this enormous capital has never been investigated or verified. If an official investigation were to take place, probably as great a reduction would have to be made as was done in the case of the water companies many years ago, whose capital, on inspection, was reduced, in a number of instances, by 30 per cent.

"In short, there is hardly a more crying abuse connected with the metropolis than the mismanagement of some of its gas companies and their exactions upon the consumers.

"LONDONER."

The following replies have since been inserted in the City article of *The Times*:—

"Sir,—Your correspondent 'Londoner' is under a misapprehension. The enormous capital of the gas companies has all been investigated and confirmed by Parliament. No reduction of capital was made in the case of the water companies at all. What really occurred was this: one water company, in prosecuting their bill in Parliament in 1852, put their capital at the market value of the shares, and not at the subscribed or paid-up amount.

"The value so placed was £830,000. It is not correct to say that the capital was reduced, because this sum was not confirmed. The committee proceeded to discover what the true capital of the company really was, as, of course, there was no ground for adopting the market value as the basis of capital.

"They found that the sum of £395,450 had been paid upon the share account; that a sum had been expended on plant out of revenue of £111,247—making a total of £506,697, at which amount the capital was fixed.

"This is certainly reducing an hypothetical estimate, but the subscribed capital was really added to nearly one-third. A precisely similar principle was adopted upon the amalgamation of two other companies in 1845.

"I think, upon the eve of an inquiry by a parliamentary committee, which the gas companies in no way shun, the concluding paragraph of your correspondent's letter is unjustifiable.

"*May* 19." "A LONDON GAS SECRETARY.

"*London*, *May* 20.

"Sir,—The statements contained in the paragraph relating to metropolitan gas companies, in the money article of *The Times* of the 19th inst., and in its subjoined letter, signed 'Londoner,' if not evincing an actual intention to pervert facts and mislead public opinion, at least betray the greatest possible ignorance of the subject dealt with.

"Without entering upon the case of any of the other eight gas companies which now supply London with gas, it is sufficient for my purpose to state that The Gaslight and Coke (commonly called the 'Chartered') Company, of which I am a director, and which is the oldest and the largest gas company in the world, and, in fact, supplies not far short of one-third of the metropolis, was, at the instance of the Corporation of London and the Metropolitan Board of Works, placed by the City of London Gas Act, 1868, directly under the supervision and control of the Board of Trade, which has appointed:—

"1. A scientific body of gas referees, whose duty it is, *inter alia*, to prescribe the degree and method of testing the purity of the gas manufactured by the company.

"2. Commissioners who, after investigating the expenditure of the company to ascertain whether its affairs are being administered 'with due care and management,' are to fix the price of gas.

"3. An official auditor who is to prescribe the form in which the accounts of the company are to be kept, and to continuously examine, audit, and certify the same.

"The Act requires that the illuminating power of the gas supplied by the Chartered Company shall be not less than 16 candles—that is, two candles higher than is required from any other company in London, and it requires the company to provide and maintain testing offices and apparatus, and the Corporation of London and the Metropolitan Board of Works to appoint and keep appointed competent gas examiners, whose duty it is to test daily the illuminating power and the purity of the gas supplied by the company. For

16-candle gas the price now charged by the Chartered Company is 3s. 9d. per 1000 feet, with, I am happy to say, the prospect of a further reduction at a not very remote period.

"The entire conditions under which the company supplies its customers are regulated in the most stringent manner, and under very heavy penalties, by the Act I have recited. It is, therefore, absolutely incorrect to say that we 'impose what conditions we please on our customers, and change our terms also pretty much when we please.'

"The Chartered Company, like all other gas companies, does require the payment of a deposit from doubtful customers, equal to the estimated amount of one quarter's consumption; the payment of interest on the amount so deposited is provided for in the Metropolis Gas Act, 1860 (incorporated with the City of London Gas Act, 1868); both the principal and interest pass under the eye of the official auditor, who examines our accounts in a most minute and searching manner, and deals with them generally as he thinks fit; and by the 81st section of the Act of 1868 he is not only empowered, but required to stop the payment of a dividend to the shareholders if 'he finds the accounts of the company incorrect in principle or in detail.'

"On the eve of a struggle before a parliamentary committee it is not my intention to enter into an argument with 'Londoner' as to the probability of Parliament now repudiating a compact as to dividends solemnly made with the companies in the year 1847, and since twice and most deliberately renewed in the years 1860 and 1868. But as regards his second point, the Government auditor can show that no money has been raised by the Chartered Company on loan which has been subsequently converted into share capital, and that out of the total share capital of all the nine metropolitan gas companies, which now amounts to above eleven millions sterling, upwards of seven millions have been actually investigated and verified by him.

"I do not know to which of the metropolitan gas companies the final observation in the letter of 'Londoner' may have reference, but as a proof that it can have no application to the Chartered Company, I may observe that that company introduced into Parliament in the present session a bill, one of the objects of which was to enable it to raise all future capital, not by shares which should bear 10 per cent. interest to the holders, but by debentures, on which the company can now raise money readily at 4½ per cent. This bill was defeated on a technical objection raised by the Metropolitan Board of Works, who were afraid to allow it to go before a committee on its merits.

"Permit me to conclude by remarking that it will be proved before the committee to whom the Metropolis Gas Companies Bill will be referred, that, owing to the care taken by the Board of Trade and by Lord Cardwell's committee in framing the City of London Gas Act, 1868, 'the crying abuses,' 'the mismanagement,' and 'the exactions upon the consumers,' alleged by your correspondent, exist only in the minds of vestrymen, and of those who will write on subjects which they have not taken sufficient pains to understand.—I am, sir, your obedient servant,

"ROGER EYKYN."

"*May* 20.

"Sir,—The letter on the position of the metropolitan gas companies signed 'Londoner' published in your City article of yesterday, which derives importance from your introductory observations, is calculated to do the gas companies so much injury, especially at the present time, when an inquiry by a committee of the House of Commons is pending, and the subject may be said to be *sub judice*, that I have to request you will afford space for the following statements:—

"The accounts of three companies who supply at least two-thirds of the metropolitan area with gas are subject to the continuous examination of an official auditor appointed by the Board of Trade, and no dividend can be declared until such auditor certifies and approves the accounts both as respects capital and revenue. It is, therefore, incorrect to say that there is no efficient supervision over the companies accounts.

"The gas companies referred to have no power whatever 'to impose such terms and conditions as they may please.' The Acts of Parliament define exactly the terms which the companies have to comply with. Neither have the companies any power of themselves to raise the price of their gas above the maximum of 3s. 9d. per 1000 feet named in the Act. If, in consequence of any great rise in the cost of coal or other circumstances, the expense of making gas is largely increased, the question whether the company may be allowed to raise their price is wholly a matter of arbitration. Three commissioners, to be selected and appointed by the Board of Trade, conduct the needful inquiry, and their decision is without appeal.

"The gas supplied by the companies is tested both for illuminating power and purity continuously during the hours of consumption every day, by skilled chemists appointed by and under the control of the Metropolitan Board of Works, and if at any time the gas is found defective in any respect, the companies are subject to heavy penalties.

"The companies are also compelled to furnish an adequate supply of gas to any one who may desire it; and as the demand for gas increases at the rate of about 8 per cent. per annum (thus doubling the demand every 12 years) more capital must of necessity be constantly laid out in constructing the new works and laying down the new mains, by means of which such additional quantity of gas is to be made and delivered.

"This increase of capital is, therefore, not optional with the companies, but is an obligation imposed upon them by the Legislature. Moreover, in the case of the Imperial Company, on whose behalf I more particularly write, the dividend on all the new capital raised for this purpose is limited, and has been limited, since the year 1866 to 7 per cent., not 10 per cent., as stated by your correspondent, and at the present time the dividend on one-half of the company's capital is limited to 7 per cent. only.

"With reference, also, to the statement of your correspondent that most of the 'enormous capital' of the companies has never been investigated and verified, I beg to say that the official auditor has investigated the accounts relating to the expenditure of capital by this company from the commencement of the undertaking, and I presume that he has done the same, as required by the Act, with the accounts of the two other companies subject to his jurisdiction; so that two-thirds, at least, of all the capital raised and expended by the metropolitan companies has been investigated and verified, as suggested by your correspondent.

"There are other inferences in the letter of less importance which should, perhaps, be corrected; but this communication, it is feared, has already reached the dimensions your space will allow. Sufficient, however, has been said, it is hoped, to show that a very erroneous impression exists with respect to the position of the metropolitan gas companies.—Yours obediently,

"HARRY CHUBB,
"Secretary of the Imperial Gas Company."

STONEHAVEN GAS COMPANY.—The annual general meeting of this company was held at the company's office on Monday, the 17th inst.—Mr. Alex. Weir, chairman of the directors, in the chair. A balance-sheet of the company's affairs was submitted, which, having been duly audited, was approved of, and the usual dividend of 10 per cent. agreed to, and ordered to be paid on the 1st of June next. On the motion of Mr. James Anderson, a vote of thanks was awarded to the directors for their services during the year past. This concluded the business before the general meeting. At a meeting of the directors held immediately afterwards, it was resolved to reduce the price of gas 10d. per 1000 feet from the 1st inst., being a reduction of 1s. 8d. since the 1st of November last, and making the present price 5s. 10d.

BOMBAY GAS COMPANY, LIMITED.

The Ordinary Meeting of this Company was held at the Terminus Hotel, Cannon Street, London, on Thursday, the 20th of May—D. T. EVANS, Esq., in the chair.

The SECRETARY (Mr. W. Marshall) read the notice of meeting and the minutes of the last meeting, which were approved.

The following report and statements of account were presented:—

Your directors have pleasure in submitting to the shareholders a statement of accounts, duly audited, for the half year ending the 31st of December last.

The position of the company continues satisfactory. There is an increase in the gas and meter rental; but a decrease in the sale of coke (which is due to the fall in price of coal); a fair profit has been made on fittings, whilst the general charges show a considerable reduction.

The rate of freight ruling low for some time past, your directors, watching the market from time to time, have put into stock on the works, and have now afloat, a quantity of coal at a low figure, which will have a material effect on the working of the company during the current year.

The Municipality of Bombay have recently added 70 lamps to the number of the public lights.

The accounts show a net profit for the half year of £11,746 16s. 8d.; and, after appropriating £1500 to the reserve-fund (raising it to £6950 12s. 11d.), and writing off for depreciation £1259 2s. 3d., your directors recommend the shareholders to declare a dividend at 4 per cent. (making 7½ per cent. for the year), free of income-tax. This will absorb £9600, leaving a balance of £589 8s. 1d. to be carried forward to the credit of next half year.

The rates of exchange have continued depressed; and in order that the losses thus incurred may not unduly weigh on one half year more than another, your directors have determined to form an "Exchange Equalization Account," and have carried to the credit of that account £600.

The director retiring by rotation is Henry Palfrey Stephenson, who, being eligible, offers himself for re-election.

The auditors, Edward George Bradley and Robert King, retire from office, and, being eligible, offer themselves for re-election.

The dividend will be payable on after the 1st of June next.

Dr. *General Balance-Sheet, Dec.* 31, 1874. *Cr.*

Capital authorized—				Construction account		£198,947	4 2
(50,000 shares, at £5 each—£250,000.)				Less written off preliminary expenses account		200	0 0
40,000 shares, £5 paid	£200,000	0	0			£198,747	4 2
10,000 „ £4 paid	40,000	0	0	Goods *in transitu*		13,041	9 0
Debentures	14,950	0	0	Services account		83	0 0
Amount owing by company	9,298	3	11	Retort account		1,116	17 8
Reserve-fund £6,709 15 2				Stock in trade, viz.—			
Added this half year 1,500 0 0				Chandeliers, &c.		6,270	12 5
	£8,209 15 2			Brass and iron goods, tubing, &c.		5,488	7 1
Written off depreciation, &c. 1,259 2 3				Materials, mains, and services		1,543	11 6
	6,950	12	11	Meters		2,696	3 3
Exchange equalization account	600	0	0	Coal		2,094	4 4
Insurance-fund	1,049	0	9	Coke		936	16 0
Passage-fund	340	0	0	Tar		244	3 3
Balance to general revenue account	10,189	8	1	Tools and sundries		783	5 4
				Amount owing to the company		6,704	6 10
				Cash at bankers, on deposit, and in hand		43,627	4 10
	£283,377	5	8			£283,377	5 8

Profit and Loss Account, for the Half Year ending Dec. 31, 1874.

Coal carbonized	£7,054	1	4	Gas and meter rental		£18,984	0 1
Wages	1,099	6	5	Coke		4,008	18 9
Purifying	13	8	9	Tar		665	16 0
Maintenance of retorts	343	7	6	Fittings		526	13 0
Trade and general charges	1,191	11	2	Interest		699	6 5
Salaries and collectors commission	1,537	14	6	Transfer fees		16	12 5
Rents, rates, and taxes	294	15	4				
Directors and auditors remuneration	626	5	0				
Bad debts	170	15	9				
Law expenses	32	16	7				
Exchange	790	7	8				
Net profit	11,746	16	8				
	£24,901	6	8			£24,901	6 8

General Revenue Account, Dec. 31, 1874.

Dividend	£8,400	0	0	Balance, June 30, 1874		£9,123	1 5
Amount carried to reserve-fund	1,500	0	0	Net profit for half year ending Dec. 31, 1874		11,746	16 8
Interest on debentures	580	10	0				
Written off preliminary expenses account	200	0	0			£20,869	18 1
Balance carried down	10,189	8	1				
	£20,869	18	1	1875, Jan. 1.—By Balance brought down		£10,189	8 1

The CHAIRMAN: Gentlemen, the report and statements of account which have been circulated amongst you, being very copious and explicit, will, I hope, be deemed satisfactory. I think, however, I can supplement them with some further information, which should be exceedingly assuring and agreeable to you. The state of the company's affairs, as we inform you in our report, is eminently satisfactory. We have not only maintained the dividend, but we have added to the reserve-fund £1500, and we have written off for depreciation £1260. The reserve-fund now stands, in round numbers, at the respectable sum of £7000. Now, I will just glance back at the history of this company. It was incorporated in April, 1862, and in October, 1865, the city of Bombay was first lighted with gas, so that, in point of fact, we have not had ten years clear working of this undertaking. I should add that we erected works, which, I think, are almost unexampled out of Europe for magnitude and completeness, and we canalized Bombay with mains and pipes to the extent of over 70 miles. I think, too, I may say that in the public lighting we have given to the Municipality the most entire satisfaction; and we have furnished the private consumers throughout the city with gas of excellent quality. It has been my custom on these occasions, and more especially at our annual meetings, to review somewhat fully the working of the company in the past year, and that I propose to do again to-day. If you will look at the general balance-sheet, you will find that, as contrasted with 1873, in the item of "Chandeliers and brackets," there is a decrease of £865; in "Brass and iron goods, tubing, &c.," a decrease of £1174; in "Materials, mains, and services," a decrease of £310; and in "Meters," a decrease of £311. These decreases are evidence of stock and materials utilized, and therefore favourable. In the cost of coal carbonized, there is a decrease of £5562; there is a decrease also in "Tar," amounting to £116; and in "Tools and sundries," £400, while in coke there is an increase of £537, nearly all of these items being favourable to the company. In the general balance-sheet you will be struck with one item at the bottom—viz., "Cash at bankers, on deposit, and in hand, £43,627." Now, you must not run away with the idea that, because we had that large sum at the bankers and in hand, it is distributable, or that, in point of fact, any part of it is distributable. And I must justify what I say by calling attention to the balance-sheet itself, in which you will see that, in addition to the £43,627, there was an amount owing to the company of £6704, making a total of £50,331. But now look at the liabilities on the other side. The amount owing by the company was £9300, chiefly for coals. We also require for debentures which we have to pay, £14,950; for interest on debentures, £580; and for dividend, £9600; making a total of £34,438. That would leave a

surplus of £15,293. But there was also £7000 due to the reserve-fund, and £1000 to the insurance-fund. This surplus has been, or will be, wholly swallowed up in the purchase of coals. We had worked down our stock on Dec. 31 to 966 tons. You will remember that we laid out a very large sum of money in coals when freights were low and coals were cheap, so that we were able to tide over the coal-famine successfully, and in doing so we brought down our stock very low. Now we are laying in coals again, because freights are low and coals are relatively cheap. Since Dec. 31 we have laid in upwards of 13,000 tons, at a cost of about £26,000; so that you will see our working capital is not too large. And I have not mentioned a circumstance which I ought to refer to—viz., that we shall have to make a considerable extension of our mains, and that to do so we had better borrow from ourselves than from the outside, if we have any funds available for the purpose. With these remarks I pass to the profit and loss account, in which, I am happy to say, nearly all the items are favourable. The coal carbonized amounted in the half year to £7054, as against £7224 in the corresponding period of 1873, showing a decrease of £170, and this although we have made more gas and have sold more gas. In wages there is also a diminution, the amount being £1099, as against £1181, being a decrease of £82. Purifying cost £13, as against £29 in 1873, being a decrease of £16. In maintenance of retorts there is an increase of £246. Acting upon the advice of my friend, Mr. Stephenson, we have erected a new bench of through oval retorts, the working of which has improved our carbonizing, and fully justified the expenditure. In trade and general charges there is an increase of £188; in salaries and collectors commission a decrease of £318, the amount being £1537, as against £1855. Rents, rates, and taxes have decreased £96; and in bad debts there is an increase of £128; but, after all, this is a very trivial and insignificant affair with an income of some £50,000 a year. In law expenses there is an increase of £26, and in exchange a decrease of £350. The exchanges have been adverse to us for so long a time, and to such an extent, that we have thought it best to equalize and distribute this loss over a period, and we have formed an "Exchange Equalization Account," which we have credited with £600. If you look at the gas and meter rental, you will see that it amounts to £18,984, as compared with £18,943 in the corresponding period of 1873, being an increase of £41. In receipts for coke there is a decrease of £445, which is due to the circumstance that the price of coke does more or less follow the price of coal. When we were burning cheap coal, however, we were selling coke at a high price—sometimes as much as £3 per ton. In the sale of tar there is an increase of £57; in fittings a profit of £526; and in interest an increase of £318. Now, I pass to the general result of the working of the company, and that is, I consider, very satisfactory. The gas made in 1874 was 65,951,000 cubic feet, as compared with 63,373,000 in 1873, showing an increase of 2,578,000 cubic feet. The gas sold in 1874 was 59,546,100, as compared with 57,170,100 cubic feet in the corresponding year 1873. There was an increase, therefore, of 2,376,000 feet. The leakage, which was high in 1873, is not quite so high now; indeed, we think, all things considered, it is by no means excessive. It amounts to 9¾ per cent. as compared with 10 per cent. last year. The make of gas per ton of coal in 1874 was 9892 cubic feet per ton of coal carbonized, and the sale of gas 8931. The cost of coal into the retorts in 1874 was £2 2s. 1d. per ton, as compared with £2 2s. 11d. in 1873. The general revenue account speaks for itself, and I have no remarks to make upon it. I have now a communication to make to you which is very gratifying to the directors, and I think it will be very acceptable to the shareholders. You will remember that the contract made with this company by the Municipality of Bombay for the public lighting was for a period of seven years, which would expire in 1878. It was, therefore, most desirable to obtain, if possible, an extension of the contract; and I am happy to communicate to you the fact that we have, after much anxious consideration, a great deal of correspondence, and frequent telegrams, negotiated another contract with the Municipality of Bombay—a contract which practically gives us a monopoly for a term of 14 years from the moment it comes into operation, which will be from the time when we shall have erected 750 additional public lamps. I am happy also to be able to give you this further assurance—that our works are in good condition. We have renewed one of our gasholders, which showed symptoms of decay, and required extensive repairs. We have also, as I said, erected a new bench of oval retorts. Just one word as to the future of the company. The Prince of Wales is about to pay a visit to our great Eastern dependency, and that, no doubt, will give our revenue a considerable fillip. When the Duke of Edinburgh went to Bombay, we made a handsome profit, and we expect to make more on this occasion, supposing that His Royal Highness should visit Bombay, as no doubt he will. I may add that we have an increase in the private consumption. That has been a matter of some anxiety to us for a long time past; but there is now, and has been for some months, a steady increase, which I hope will continue.

A SHAREHOLDER: What is the cost of coal free on board?

The CHAIRMAN: It depends, of course, upon the description of coal sent out. The Pelaw Main costs us about 11s. 6d. per ton, free on board in the Tyne. We used to ship a considerable quantity of coal from the Australian coal-fields. It is a compact and heavy coal, and we found it work advantageously, but the whole of the Newcastle collieries in New South Wales have come to an arrangement not to sell coal under 14s. a ton, and that price, with the cost of freight, has prevented us from shipping any of that kind, as we can send out coal cheaper from this side. The average freight has been from 25s. to 30s. a ton, and there is a further cost of about 3s. 6d. per ton landing charges and insurance. We are now putting English coal into the works at £2 and less. In conclusion, I have to move—"That the report and statement of account circulated amongst the shareholders be received and adopted, and that a dividend for the half year ending the 31st of December, 1874, of 4 per cent., free of income-tax, be now declared, payable on and after the 1st of June next."

Mr. LYSLEY seconded the motion.

Mr. MORRISON said he was connected with another gas company in the East, in which it was found very advantageous to have a local committee. He suggested to the directors whether a similar arrangement at Bombay might not tend to extend the interests of this company in that city.

The CHAIRMAN said it would not be possible for him to express an opinion off-hand as to the prudence of the suggestion, but it was one which he would submit to his colleagues on the direction for their consideration.

The motion was then put and carried.

The CHAIRMAN said the next resolution he had to submit was the re-election of Mr. H. P. Stephenson as a director. He had great pleasure in proposing it, knowing thoroughly well the great value of the services that gentleman had rendered to the company.

Mr. SARSON said he esteemed it a privilege to second the motion, and was much pleased to think that that company enjoyed the advantage of the counsel of a person of Mr. Stephenson's skill and experience in gas matters.

The motion was put and carried.

It was proposed by Mr. STOKES, and seconded by Col. ROBINSON, that Messrs. Bradley and King be re-elected auditors, and the motion was agreed to.

Mr. STOKES said at the last annual meeting a gratuity of one hundred guineas each was voted to the secretary and to the manager. He thought the shareholders could not do better than follow that precedent on the present occasion. These gentlemen must have had a great deal of care, anxiety, and labour in carrying out the arrangements for the new public lighting contract, and he moved that they be presented with one hundred guineas each.

Major-General RIGBY said, as the mover of a similar proposition last year, he had great pleasure in seconding the motion now before the meeting. It was a small mark of the satisfaction of the shareholders with the conduct of officers who had so much to do with the successful management of the company.

Mr. STOKES asked the chairman whether such a motion was agreeable to the directors.

The CHAIRMAN said he should be very sorry to withhold his assent. He was sure the feeling which dictated the motion would be highly appreciated by the manager in Bombay, of whom it was impossible to speak too highly. And he might say the same of his friend Mr. Marshall, whose zeal and assiduity in the discharge of his duties were worthy of all commendation.

A SHAREHOLDER said he thought the repetition of the vote was being made too soon, and that it would be better to delay it for the present.

Mr. MORRISON, on the other hand, supported the motion, and said it was customary with other companies in a prosperous state to give their officers something like a bonus upon their salaries.

Mr. STEPHENSON said on the last occasion he objected to the proposal for this reason, that he did not think the shareholders were so well able to judge of the merits of the officers as the directors, who had arranged a scale of remuneration for their staff depending upon the profits, and increasing with the success of the undertaking. He could not speak too highly of the services of the secretary and manager; but when a proposal of this kind was suddenly made to a meeting, it placed the directors in a most unfortunate position, if at any future time they might feel a difficulty in assenting to such a proceeding.

The CHAIRMAN said he felt that it might hereafter give rise to some inconvenience.

The motion was put and carried.

Major-General RIGBY moved a vote of thanks to the chairman, the directors, the secretary, and manager. He said he felt that every one connected with the company deserved the approval of the shareholders, and he regarded the small attendance at the meeting as a proof that the utmost confidence was placed in those who conducted their affairs.

Colonel ROBINSON, in seconding the motion, observed that it would be well if shareholders who desired to bring forward a proposal similar to that just adopted would give previous intimation of it, so that the directors might not all at once be brought face to face with a motion which they might feel a delicacy in withholding their assent to.

The CHAIRMAN said it was, no doubt, highly desirable, but it was difficult to know how to effect it.

Major GORDON said he thought it right to state that he believed the proposition was as much a surprise to the secretary as to the directors.

The vote of thanks having been carried,

The SECRETARY said: Gentlemen, allow me to return my sincere thanks for the vote you have passed. When I entered this meeting, I had no idea that before leaving it I should be the recipient of so munificent a gift which, as a repetition of your vote of last year, is doubly gratifying to me; and I have no doubt it will be so to Mr. Scott. I presume to say that I have endeavoured to do my duty, in the hope that my efforts might contribute to the prosperity of the company, and it is the consciousness of having done so which enables me to appreciate your liberality. At the same time, I desire to tender my thanks to the directors, who have always treated the officers of the company in the most liberal manner consistent with judicious economy and the exigencies of the service. I have also to acknowledge your kindness in the name and on behalf of the manager and officers in Bombay. As toilers under a burning sun in a tropical clime for our welfare they deserve to be encouraged, and it will be cheering to them to know that their labours are not forgotten or undervalued by you.

The CHAIRMAN: On behalf of my brother directors and for myself, I tender my thanks to General Rigby for the kind manner in which he proposed the last vote, and I thank you, gentlemen, for the cordial manner in which you have received it. We have hitherto, I presume to say, done our duty, and we shall continue to use our best exertions for the interests of the company.

The proceedings then terminated.

HULL GAS SUPPLY.

A Meeting of the recently appointed Gas Inquiry Committee of the Corporation of Hull was held in the Town-Hall on the 4th inst., when the following report from the law clerk to the Board of Health was received. The report was ordered to be printed and circulated. A deputation was appointed to wait on the gas companies in the town:—

TO THE GAS INQUIRY COMMITTEE.

Gentlemen,—In accordance with your resolution—"That the law clerk report to this committee—

"1. On the powers and duties of the gas companies supplying Hull with gas.

"2. As to the present powers of the board with respect to their breaking up the streets of the borough, and

"3, and lastly. As to what further powers are or will be necessary, in order to enable the board to take the gas into their own hands, and how such further powers can be obtained."

I beg to report, first, that the oldest gas company in Hull was incorporated in 1824, under the 1st and 2nd Geo. IV., cap. 5, under the name of "The Kingston-upon-Hull Gaslight Company," and their powers and duties are contained in such Act, and extend over the district of the town of Kingston-upon-Hull, the lordship of Myton, the liberty of Trippett, and the parish of Sculcoates.

By the Act the company is empowered to purchase lands, &c., to the extent of 10 acres, to raise a capital of not exceeding £17,000, and to borrow not exceeding £4250.

By another section the liability of the shareholders is limited, and the stock of the company is divided into £25 shares, and no subscriber allowed to hold more than 25 shares.

The corporation, the dock company, and the Trinity House, are authorized to become shareholders.

The votes of the shareholders are according to the number of shares held, but the number of votes is not to exceed ten.

The shareholders dividends are unrestricted as to amount, but are to be made out of the "interests, profits, or advantages of the undertaking."

The company and their successors are empowered to build gas-works, &c., and to break up the soil of the streets, &c., and to dig trenches and drains, and to lay mains or pipes, &c., in, under, across, and along such places and in such manner as shall be necessary for the purpose of carrying the Act into execution, or supplying the gaslights authorized thereby, and to alter the position of and repair, relay, and maintain such pipes, &c., in, to, or through any dwelling-house, &c., for the purpose of lighting the same, or any public or private lamp from any such mains or pipes, and to erect any apparatus necessary for securing a competent supply of gas, or measuring the extent of such supply, and to mend any bad or inperfect work, &c., and to do all such other acts, &c., as the company and their successors shall think necessary for completing and repairing, improving, supplying, and sustaining the same; the work to be done with despatch, and a proper compensation made for all damage done.

The company, before carrying pipes, &c., through or against any dwelling-house &c., are to obtain the consent of the owner and occupier.

The company are required to remove pipes, &c., on private property, on notice. The rights of the dock company, &c., are not affected by the Act, without the dock company's consent, nor the powers of the Myton and Soulcoates Commissioners.

The water-pipes of the corporation are to be protected, and the soil near them prevented from being broken up without previous notice, and all gas-pipes are to be laid 4 feet from such water-pipes, and in the manner prescribed by the Act.

The company are required not to injure public drains, and to repair same, the amount of damage being recoverable by the corporation.

The Act authorizes the company to negotiate with any body corporate, commissioners, or persons acting in the execution of any Act of Parliament, and having local authority, to contract for lighting lamps in the "town, lordship, liberty, and parish," any or either of them, as in the Act is mentioned, any such contract to be voided on three months notice; and streets, &c., are in that case to be made good by the company.

Nothing in the Act is to prevent the company from being indicted for a nuisance, and the powers of the then local Act are reserved.

Under this Act the old town was lighted by the Kingston-upon-Hull Gaslight Company, but no other part of the borough seems to have been interfered with.

Secondly in order of time comes the "British Gaslight Company," and their powers and duties are set forth as follows:—In the first instance the company was established by deed of settlement, dated Feb. 1, 1824, "for the purpose of manufacturing and supplying gas in cities, towns, and other places." The company was subsequently incorporated with limited liability under the Joint-Stock Companies Acts, 1856 and 1857, under the name of "The British Gaslight Company, Limited," and in 1858 the company obtained their present Act, entitled "An Act for better enabling 'The British Gaslight Company, Limited,' to light with gas certain parts of Kingston-upon-Hull, and for other purposes," and in this Act the Gas Clauses Act, 1847, is incorporated, except as therein mentioned.

The limits of the company's operations are by the Act confined to the west district of the Borough, except the old town.

The Act empowers the company to maintain their existing buildings, works, &c., and enacts that all works and operations undertaken by the company are to be executed so as not to interfere with the sanitary condition of the borough or with the powers of the Local Board of Health, as defined in the 71st section of "The Public Health Act, 1848;" and that all such works and operations are to be subject to such reasonable regulations as the Board of Health might see fit to impose consistently with the due fulfilment by the company of the objects and purposes of their Act. These objects and purposes are substantially the same as those of the first-named company, and need not be repeated. The company it is, however, declared shall not, without the authority of Parliament, "sell their works," but continue to supply gas until authorized by Parliament to discontinue the same. Their dividends are not to exceed 10 per cent. upon their then capital of £57,624, and £7 10s. per cent. upon their additional capital of £42,376 by the Act authorized to be raised. The Act provides that after the 1st of October, 1858, the company shall not charge higher for gas than 5s. per 1000 cubic feet, and that all gas supplied by them shall be equal to "10 sperm candles of 6 in the pound, burning 120 grains per hour."

The company on application by any owner or occupier, where mains exist, are bound to supply gas for any house, &c., although there are gas-rents in arrear by a former tenant, and if for 10 days, and after receiving a deposit of a reasonable sum for the gas to be consumed, the company shall neglect to supply the same, the company we to forfeit a penalty of £5, and £5 for every day during which the neglect shall continue.

The company are bound to lay down service-pipes from any of their mains within a distance of 15 yards, in the manner prescribed by the Act.

The Local Board of Health, or other corporation or persons having authority for lighting the street within the limits of the Act, may require the company to light public lamps at such price as may be agreed upon, or in case of disagreement the same shall be settled by arbitration in the manner provided by the Act. The company are not to charge for the gas to public lights higher than the lowest price charged to any private consumer.

The Act provides for testing the quality by meter, and for the appointment of an inspector of meters, and for the charges for meters, &c.

The Act also reserves the rights of the corporation, local board, and the Hull Dock Company.

Under the foregoing Act the west district of the borough has been lighted by the British Gaslight Company.

Thirdly, in order of time is the "Sutton, Southcoates, and Drypool Gas Company," and their powers and duties are set forth as follows:—The company was incorporated in 1867, and authorized to make further provision for lighting with gas the East district and adjoining places in the borough of Kingston-upon-Hull and in the east Riding of the county of York, and to raise additional capital, and for other purposes. This company was formed in 1846, by deed of settlement, for the purpose of supplying the parish of Sutton (partly in the borough and partly in Holderness) and the township of Southcoates in the parish of Drypool, and the said parish of Drypool, both within the borough, with gas, and generally of carrying on the business usually carried on by gas companies.

By this Act the company's capital is to be £76,000. The dividends are limited to £7 10s. per cent. per annum. The company are empowered to borrow on mortgage £5000. The company is empowered to purchase not exceeding three acres of land and to maintain their then three present, and construct additional works.

The company are empowered to break up streets, &c., for the purpose of laying pipes within the limits of their Act, upon similar conditions to those contained in the other Acts. The works of the dock company are exempted without consent. The works of the company within the borough are to be executed so as not to interfere with its sanitary condition, or with the powers of the Local Board of Health, as defined in the 71st section of the "Public Health Act, 1848," and all such works, &c., are to be subject to such regulations as the local board may see fit to impose, consistently with the due fulfilment by the company of the objects and purposes of the Act. The company are to provide their own service-pipes to buildings as in the other Acts, and to light the public lamps at the request of the local board, the charge being restricted to the lowest price charged to private consumers.

The local board is empowered to test by meter the supply of gas to their public lamps. The company's charges to their consumers by meter are to be within the municipal borough 4s., and beyond it 4s. 6d. per 1000 cubic feet, the gas to be supplied being 14-candle gas.

The Local Board of Health is empowered to test the purity of the gas supplied, and the company are liable to a penalty of £10 for supplying gas of inferior illuminating power. Inspectors of meters may be appointed by the local board.

In 1873, a further Act was obtained by the company, "amending their Act of 1867," but it does not affect the provisions set out, so far as the public is concerned.

It will be seen that there is a difference in the three Acts regulating the supply of gas to the borough, not only as to the price to be charged per 1000 feet and the illuminating power, but also the limitation of dividends; nor can the works of "The British Gaslight Company," as already stated, be sold without the authority of Parliament.

The Act of the "Kington-upon-Hull Gas Company" does not incorporate the Gas Clauses Act by which (as in the cases of the other two companies) their dividends are limited, the price of gas regulated, and also the illuminating power.

The price of gas as at present supplied to private consumers is as follows:—

Kingston-upon-Hull Gas Company	Unrestricted.		
Present charge per 1000 feet	£0	4	6
British Gaslight Company can charge	0	5	0
Present charge	0	2	6
Sutton, Southcoates, &c., Company are empowered to charge within the borough	0	4	0
Present charge	0	4	0
Beyond the borough	0	4	6
Present charge	0	4	6

As to the illuminating power of the gas supplied—The Kingston-upon-Hull Gas Company are unrestricted. The average quality of the supply at present is equal to 16-candle gas. The British Gaslight Company must supply 10-candle gas. The quality supplied during the past month (April), according to official report of the company's own analyst (Mr. Jas. Baynes), is 17·09 maximum, 15·99 minimum, 16·34 mean. The Sutton, Southcoates, &c., Company, must supply 14-candle gas. The quality of the supply during April, according to official report of their own analyst (Mr. Baynes, jun., F.C.S.), is 16·24 max., 15·82 min., 16·06 mean.

The dividends which may be taken by their shareholders may be as follows:—The Kingston-upon-Hull Company's dividend is unrestricted. The British Gaslight Company pay £10 per cent. on their first capital of £57,624, and £7 10s. per cent. on additional capital of £42,376. The Sutton Southcoates, &c., Company pay £7 10s. per cent.

The foregoing are the chief powers and duties of the three companies supplying gas to the borough, and it will be seen that each of the companies in their respective districts have, with the express or implied consent of the corporation, the power to break up the various streets of the borough.

The present powers of the board will have been gathered from the foregoing observation. By the Act 12 and 13 Vict., cap. 94, passed previously to the British and Sutton, &c., Companies Acts, the board was authorized to contract for the supply of gas to the public lamps for any period not exceeding three years at any one time with any company for supplying gas or other means of lighting the streets, &c., and public buildings within their respective districts, and to provide the necessary lamps, lamp-posts, and other materials for the purpose, and to charge the expense to the general district rates. It has been the practice since the last-mentioned Act was passed for the board to enter into contracts with the three companies for the supply of gas to the various districts into which the town is divided.

The powers necessary for the future require great consideration on the part of the committee. At present the corporation have, as it seems to me, no general powers, except those already shown in this report. These powers, by the bill now before Parliament, for "consolidating and amending the Acts relating to the public health in England," are proposed to be extended by two clauses in such bill; by one of which—sec. 154—urban authorities will be authorized to contract for the public lighting of their districts, not merely for three years, but for any longer time, and the other—sect. 155—authorizes "any urban authority to buy, and the directors of any gas company, by the authority of three-fifths of their shareholders, who may be present either personally or by proxy, at some special general meeting, to sell to such authority, on such terms as may be agreed on between the authority and the company, all the rights, powers, and privileges, and lands, premises, works, and other property of the company, but subject to all liabilities attached to the same at the time of such purchase."

If these clauses become law, it would appear that the sanitary authorities throughout the kingdom will have power to contract for the supply of gas for any period, and also power to purchase existing gas-works to the extent and in the manner shown.

Whilst these clauses extend the present limited powers of corporations, it is clear that at present the Local Government Board have no intention this session of carrying the matter further, the president having stated in the House of Commons the other evening that the Government did not intend to introduce any further or other special measure this session for enabling municipal corporations or sanitary authorities to acquire gas-works by agreement, and that, as I have before stated, there was no power at present under the general law to enable such bodies to purchase such works.

It is clear, therefore, that either to build or purchase compulsorily gas-works in the borough the corporation will have to apply to Parliament for the necessary authority, and this can only be done by a Special Act, especially as (already mentioned) the "British Gaslight Company" cannot sell their works without the authority of Parliament.

To promote any such bill in Parliament reference must be made to the Borough Funds Act, by the 2nd section of which it is enacted that "when in the judgment of a governing body in any district it is expedient for such governing body, amongst other things, to promote any local bill in Parliament, it shall be lawful for such governing body to apply the rates under their control to the payment of the expenses attending the same," with this proviso—"That nothing in this Act contained shall authorize any governing body to promote any bill in Parliament for the establishment of any gas-works to compete with any existing gas company established under any Act of Parliament."

At present, therefore, it would appear that the corporation can only hope to promote a bill enabling them to purchase the works of an existing company or companies, and not to establish new works in opposition to those now in existence.

After a full consideration of the whole subject, in appears to me that the following courses are open to the committee:—

1. To petition in favour of the present bill, and for the insertion therein of an addition to clause 155, empowering corporations and urban sanitary authorities to build additional gas-works, notwithstanding the proviso in section 2 of the Borough Funds Act, and to manufacture, store, and supply gas therefrom, and to raise all necessary funds, free from objectionable "liabilities," if any, of any existing company, as well as merely authority to purchase existing works and their present "rights and privileges," as is contemplated by the bill now before Parliament.

2. Whether the 155th section of the proposed bill be rejected or not, the committee might apply to the Local Government Board to direct local inquiry under the 7th section of the Local Government Act, in order to an investigation of the various matters complained of by the public as to the present gas supply, and as a means of inducing the Government to introduce in the next session of Parliament a more sweeping measure, granting relief to corporations throughout the Kingdom in respect of the complaints arising from the present system.

3. The corporation may apply to Parliament next session for an Act enabling them to purchase, as has been done in Manchester, Leeds, and other places, the works of the existing companies, and to carry on the manufacture and supplying of gas upon some one of the purchased works; indeed, the purchase of the British Company's works could only be completed by such a course.

4, and lastly. The corporation, in the case of the Kingston-upon-Hull Gas Company, being by the company's Act of Incorporation allowed to become shareholders, the specified number of shares might perhaps be purchased to qualify the corporation's nominee as a director, and thereby obtain some modification of the company's present terms, and benefit the consumers in the old town, where the illuminating power of the gas supplied has not been fixed by Parliament at even so low a standard as that of either of the other companies, and which may be reduced at the option of the company, whilst the price per 1000 cubic feet, as already shown, is unrestricted, and higher at present than that supplied by both the other companies in the borough.—I am, gentlemen, yours respectfully,

C. S. Todd, Law Clerk.

Town Hall, Hull, May 3, 1875.

WEST OF SCOTLAND ASSOCIATION OF GAS MANAGERS.

The Half-Yearly Meeting of this Association was held in the Good Templars Hall, at Lanark, on Thursday, April 29, 1875—the President, Mr. ABRAHAM MALAM (Dumfries), in the chair.

On the reading of the minutes, Mr. D. M. NELSON (Glasgow) took exception to the omission, in the minutes of the proceedings of the meeting at Musselburgh, of any explanation of the absence of the president, Mr. Malam, who, he understood, had forwarded a letter stating his inability to be present.

The SECRETARY (Mr. Dunlop) explained that Mr. Malam's letter had been submitted at a previous meeting of the committee; but, if desired, he would gladly supply the omission by stating that, "in the unavoidable absence of the president (Mr. Malam), the vice-president took the chair."

This suggestion having been adopted, the minutes were confirmed, and the business proceeded with.

ADMISSION OF NEW MEMBERS.

The following gentlemen were admitted members of the association, viz.:—

Ordinary.

James M'Gilchrist, Dumbarton.
John Muter, Larkhall.
James Sinclair, Rothesay.
Laurence Hislop, Addingston.

Extraordinary.

James Henderson, coal merchant, Airdrie.
John Knox, coal merchant, Glasgow.

ELECTION OF OFFICE-BEARERS.

The election of office-bearers for the ensuing year resulted as follows:—

President—Mr. William Dunlop, Hamilton.
Vice-President—Mr. Levi Monk, Lanark.
Treasurer—Mr. Willam Smith, Helensburgh.
Secretary—Mr. James, M'Gilchrist, Dumbarton.

Members of Committee.

Wm. Young, Clippens, Paisley.
Laurence Hislop, Addingston.
Duncan Jeffrey, Kirkintilloch.
John Learmont, Milngavie.
James Renfrew, Langbank.
George Niven, Airdrie.
Samuel Black, Alexandria.

On the motion of Mr. HISLOP, a vote of thanks was cordially awarded to the retiring office-bearers.

THE GAS SUPPLY STATISTICS.

Mr. RENFREW (Langbank) called attention to the fact that, in the statistics of the gas supply of Scotland, issued in connexion with the association, the price of gas at Langbank had been erroneously entered at 10s. per 1000 cubic feet. The price, he explained, was only 8s. 9d., a reduction having been made early in 1874.

Mr. YOUNG (Clippens) thought it was a great pity that, in issuing the schedules, the committee had not given directions as to how they should be filled up, as a number of gentlemen had mistaken the figures wanted, which had led to considerable confusion. He suggested that, in order to secure greater uniformity, directions should be given for making the proper calculations, so that the statistics might be published in a better and more correct form in future years.

Mr. HISLOP said he concluded at once, from the nature of the schedule, that mistakes must necessarily occur, and he accordingly only filled up the illuminating power and the quantity of gas manufactured yearly. In adding an explanation that the company supplied the public lamps free, the number stated, 64, was inadvertently given in the published statistics as 6s. 4d. per 1000 feet of gas.

Mr. NIVEN (Airdrie) thought that the figures as to the per centage amount of leakage did not accurately convey a correct idea of the actual quantity, unless the length of mains were taken in relation to the total consumption. In his place the consumption was gradually falling off; but he could not proportionately lessen his mains. The consequence was that he had a much higher per centage leakage, although the actual total leakage was the same. He, therefore, saw no use in publishing the statistics, so far, at least, as the leakage was concerned.

Mr. M'LEOD (Glasgow) referred to the value of the returns, and mentioned the case of an American gentleman, who called upon him to obtain information as to the capacity of gasholders in relation to the consumption. The statistics compiled by the association were at once turned up, and they gave all that was wanted. His friend expressed his thanks for such a valuable compendium of information, and he felt convinced that, although in certain exceptional cases, an invidious comparison might be drawn in regard to the statement as to the amount of leakage, yet, upon the whole, he (Mr. M'Leod) felt the issuing of the return in the form in which it had been given was the wisest thing which the association had ever done, had only proper instructions been given for the correct filling up of the returns.

Mr. HISLOP suggested that in giving the amount of leakage, the number of miles of piping should also be stated.

Mr. O'NEIL (Lockerbie) concurred in this suggestion.

Mr. YOUNG said that it was to be kept in mind that the object of publishing those statistics was to supply mutual information as to how varying conditions affected individual works. There were a great many causes, over and above the length and diameter of the mains, &c., which affected the per centage of leakage; for example, in mining districts, when the surface of the streets was likely to be disturbed from the undergrounnd workings, it could be quite expected that the mains would suffer, and the per centage of leakage be thus much increased. This would necessitate an increased price for the gas, &c. But he had no doubt that members, in reading over the statistics, would understand why things were so; and he thought it would be a great benefit to the members to see the advantages and disadvantages attending the location and other circumstances surrounding other works; and, therefore, he considered it advisable to retain all the statements in the schedule.

Mr. HISLOP said that, in replying to the queries in the schedule forwarded to him, he had stated that there were either too many or too few questions. He had been three years in his present place as manager; and although the pipes were carefully laid at first, he found that by coal-working underneath, and other causes, the joints were drawn out of the sockets. He concluded, therefore, that the leakage must be particularly great in works situated in mining districts.

Mr. BLACK (Old Kilpatrick) remarked that he had had nine years experience in his present position, and that although his consumption had much increased, his leakage still remained the same.

Mr. YOUNG said that this suggested the question whether, within certain limits, it was better to have a very large main, and work at a very low pressure, or a smaller main and a higher pressure; or, in other words, whether the extra surface and joints of the large main leaked as much under a low pressure as the smaller surface and joints of the smaller main at high pressures. With specific direction for filling up the schedule, he thought the report might be made much more reliable; and he had no doubt that the suggestions offered would receive due attention from the committee at their meetings.

The subject then dropped.

Mr. MALAM read the following paper on

THE UTILIZATION OF THE AMMONIACAL WATER BY THE MALAM SYSTEM OF CARBONIZING.

At the outset I must apologize to the society for the shortness of the communication which I propose to make to the meeting, my time having been so much occupied, that I have been unable to prepare any comprehensive paper on the subject. I am myself disappointed, for it was my intention to have dealt with the subject in detail.

I may state briefly that the ordinary system of gas manufacture is so well known to you all, that any description of it would be superfluous, as would any description of the method of collecting the ammoniacal water produced thereby.

With my process, which I formerly had the pleasure of describing in the meetings of this association, you are all well conversant; but I may remind you that the gas, in its exit, comes in contact with a spray of water in the ascension-pipe, which carries down the ammonia and crude earthy matters. This water was formerly allowed to go to waste, and this, which seemed in my opinion, and of those best able to judge, the only drawback, I have disposed of in the following manner:—The water, after passing from the cisterns under the mouthpieces, is collected in the tar-well, and pumped into a tank placed at a sufficient height, and from this tank the water is again made to do duty down the ascension-pipe, is again collected and pumped up, and so on; the same water being used over and over again, until the requisite strength is obtained, when it is run off, and fresh water supplied. The method of fixing the ammonia is simply by placing a small quantity of acid in the tank, and this does it effectually.

This arrangement, which certainly gives the greatest yield of gas, is, however, attended with more trouble than another plan, by which the process can be worked, and in the carrying out of which, the ammonia is in no way interfered with, whilst the yield of gas, as compared with that obtained in the ordinary way of carbonizing, is very largely increased; in fact, any approach to the quantity of gas obtainable by this method is, by the ordinary way of working, perfectly unattainable.

In order to obviate any interference with the ammonia, the water supply, in place of being permitted to enter the ascension-pipe, is confined *exclusively* to the *outside* of the mouthpiece and ascension-pipe, a circle of jets placed at the top of each ascension-pipe, discharge a regulated supply of water, which gently flowing down the exterior of the pipe, is received in the chamber embracing the upper portion of the mouthpiece. I have in regular practice, within the past few days, put this plan severely on its trial, and find the result to be that the pipes are kept *cool* and *clear*, although carbonizing at such temperatures as enables me to produce from the ton of coal an extra yield of gas, of unimpaired quality, varying according to the class of coals used, from 1000 to 2500 cubic feet.

Thus, whilst taking advantage of the water arrangements, which as I have already pointed out, precludes the possibility of stoppages in the ascension-pipes (a great advantage in itself), and allows of such temperatures being maintained, and enables the carbonizing to be done successfully, and with largely increased profit, and *without* loss of the ammonia, the simplicity of the whole arrangement, whereby the ammonia (which is commercially valuable) is saved, is not the smallest of the recommendations in its favour, and must go far to secure success.

Mr. YOUNG observed that he would be much afraid that the use of the sulphuric acid in the manner indicated in the paper would be attended with the danger that, instead of getting all the sulphuric acid combined with ammonia, a part of it would be decomposed, more especially when it came in contact with the very hot gases and highly heated carbonaceous matter in the lower half of the ascension-pipe and mouthpiece, and would thereby produce sulphurous and carbonic acid gases, which would go to contaminate the gas, and necessitate extra treatment for their removal. The proposed plan of surrounding the stand-pipe with water was, he thought, a very much superior one to the use of the solution of acid internally. It was also much more economical, as the ammoniacal liquor was allowed to pass on and be collected in the usual way.

Mr. NELSON said that, if he understood Mr. Malam's new process thoroughly, he thought the acid was not added to the water before being passed repeatedly through the stand-pipes, but was added in the tank for receiving the ammoniacal liquor.

Mr. YOUNG held that it was utterly impossible to fix and retain the ammonia by using pure water in the stand-pipe, as, at the high temperature present in the stand-pipe and mouthpiece of the retort, the affinity of the water for the ammonia was very feeble. To fix the ammonia, it would be necessary to add the acid to the water before passing through the stand-pipes, and he understood this was the manner in which Mr. Malam used the solution of acid.

Mr. MALAM said that the acid was put into the water before passing through the stand-pipe, but that there was no decomposition, as it did not meet with sufficient heat. He had, however, only been experimenting upon the system, and it appeared to do, having the effect of strengthening the liquor to 15 or 16 per cent., according to the length of time they liked to pump the water over and over again. But he was working with water outside the ascension-pipes, which he thought better. There was a great outcry against his system, but it appeared to be the only true one. With the coke in the retorts, he was getting 9500 feet; but he could so regulate the temperature as to take off as high as 11,600 feet.

Mr. YOUNG was quite satisfied that it was possible by Mr. Malam's process, or any other where high heats were used, to obtain an increase in the quantity of gas per ton of coal; but he doubted if this could be done and retain the same illuminating power. He had also his doubts as to the use of the solution of sulphuric acid in the manner indicated. Mr. Malam might succeed, but he had always found that on bringing acid into contact with carbonaceous matter at very high temperatures, such as are present in a retort mouthpiece, the acid was decomposed, producing the gases he previously referred to. Another objection to the use of the solution of sulphuric acid would be that wherever the ironwork was not protected by the tars, it would be acted on and destroyed. He might mention that not long ago he had a very disagreeable illustration of the effects of a solution of sulphate of ammonia and free sulphuric acid on ironwork. At the works where he was engaged, one of the men in charge of the stills for extracting the ammonia had neglected to shut the valve leading to the blowing-tank, and a portion of the solution of free sulphuric acid and ammonia was drawn back and run amongst the spent liquor. The spent liquor was subsequently put into the steam-boiler to supply the steam-jets for exhausting the gas, and in a few days the acid had literally dissolved the bottom out of it. He was afraid that if Mr. Malam continued to use the solution of sulphuric acid and water for a length of time, his ironwork would suffer in a similar way.

Mr. NELSON said he did not profess to have a complete knowledge of the process, but there was one thing he was in favour of—viz., to allow no water *inside* the ascension-pipe at all. If Mr. Malam, by working at increased heats, through having the water applied outside, could produce all he had said he could produce, his system must be very much better than the ordinary process. From the view he had obtained of it, he was convinced it would be a real success in enabling him (Mr. Malam) to work at high heats, and thus extract a much larger quantity of gas. Provided he kept within the limits of the temperature, he would get this result without deteriorating the quality of the gas.

Mr. YOUNG asked Mr. Malam if, in applying the water to the outside of the pipe, the pipe was "jacketed," or if he allowed the water merely to flow over the surface.

Mr. MALAM replied that it was like a cup or saucer, and the water was allowed to run trickling down over the surface. He used pure water for the purpose.

Mr. NELSON, referring to Mr. Malam's system, said he had received a list of questions from Mr. Monk, which he would now be glad to answer, if the meeting approved. If he had answered all the letters which he had received from various parties on this same subject, his time would have been thoroughly occupied, to the neglect of his ordinary business.

Mr. MONK observed that he had seen so many conflicting statements in regard to Mr. Malam's patent in the JOURNAL OF GAS LIGHTING, that he thought the meeting should have some discussion upon it. He understood that at a meeting some time ago of the Glasgow Corporation, they had agreed, on a recommendation of the Gas-Works Committee, to erect an experimental works at the Dalmarnock station to test the Malam process. Had they done so?

Mr. NELSON stated that he had received a note from Mr. Foulis, gas engineer to the Glasgow Corporation, stating that he was about to proceed to Dumfries for the purpose of fully testing Mr. Malam's process; and he agreed, at Mr. Malam's request, to send a truck of his own coal, in order to make the necessary experiments.

Mr. MONK remarked that, although there was a greater quantity of gas manufactured by Mr. Malam's process, yet there appeared to be, by Mr. M'Crae's report to the Dundee Gas Commission, 28 per cent. unaccounted for. Even if it did increase the make, yet if it also increased the per centage of leakage, where was the use of it?

Mr. NELSON explained that the gas company at Dumfries had bought up the old Maxwelltown works, because that company were obliged to sell, in consequence of enormous loss through leakage, &c. Mr. Malam had been going back upon these pipes, and the greater bulk of the 28 per cent. said to be unaccounted for was occasioned by the badly-laid pipes on the Maxwelltown side of the river.

Mr. MALAM: I have only 16 per cent. on the consumers meters.

Mr. YOUNG suggested that, before entering upon the further discussion of the question, they should wait till they saw the result of the experiments promised to be made by Mr. Foulis and others.

Mr. MONK remarked that Mr. Malam may now only lose 16 per cent., through the gas being more permanent.

Mr. MALAM replied that the gas was permanent.

Mr. MONK observed that it had been stated in the JOURNAL OF GAS LIGHTING that it was not permanent, because the gentlemen who replied to Mr. M'Crae's inquiries, after examining the books of the Dumfries Gas Company, saw that there was 28 per cent. unaccounted for.

Mr. YOUNG said that, if properly treated, according to Mr. Malam's idea, he had no doubt that the gas would be perfectly permanent. But he thought it was pretty generally admitted that, in producing a large yield of gas by using high temperatures, the increased yield was produced by the decomposition of some of the denser illuminants and of the lighter hydrocarbons usually present in the tar, converting them into marsh gas, hydrogen, and perhaps a small quantity of acetylene and heavy hydrocarbons of a much higher boiling point. While, therefore, he believed Mr. Malam's process would make perfectly permanent gas, he had some doubts as to the permanency of the diffusion through the gas of some of the hydrocarbons necessarily having high boiling points.

Mr. MONK called attention to a letter on this subject in the JOURNAL OF GAS LIGHTING of the 27th of April, in which Mr. R. H. Patterson, replying to Mr. Smith, of Aberdeen, says: "Of course, there is a point beyond which such a course is undesirable, and a sheer waste of fuel and apparatus—to wit, when the heat is so great as to produce a large portion of non-permanent gas, which must relapse into tar again; but I do not think Mr. Malam's process is in danger of producing this result, and the objection to it made by Mr. Smith is entirely of the opposite kind."

Mr. YOUNG said he did not agree with Mr. Patterson in thinking that the gas produced at very high temperatures was not permanent. There was no doubt the higher the heat to which coal was exposed, the greater the decomposition, and the simpler were the compounds formed. By subjecting the carburetted hydrogen present in ordinary coal gas to a prolonged high temperature, almost the whole of the compounds would break up into the simple element, hydrogen, and a small quantity of acetylene, the carbon being deposited in a solid form. We all know that this gas is perfectly permanent, it being impossible to condense it by subjecting it to any known pressure or degree of cold. At the same time, being the lightest of all gases, it will leak through a given orifice at a much higher rate than the heavier gases. Gradually, as the heats are lowered, the decomposition of the coal is less. The step short of hydrogen is marsh gas, which is also perfectly permanent. As the heats are lowered, we have olefiant gas, butylene, propylene, &c.; and, at still lower temperatures, we have the gas distilled from coal in the manufacture of paraffin oil, which contains a very large volume of condensable hydrocarbons.

Mr. NELSON: It is not so much that the gas is not permanent, but the effects may be to overreach and undo what has been done before; for if you raise your heats to excess, you produce marsh gas, and sacrifice your illuminating power to what you have obtained in quantity. Mr. Malam has such an inordinate love for these high heats, that, as I have said, he may work them in such a way as to undo in great measure what he has done before.

Mr. YOUNG: I think, if I remember rightly, that at the meeting in Dumfries I suggested, as a probable improvement upon Mr. Malam's process, a modification, consisting of two or more retorts, so connected that only a portion of the gas resulting from a fresh charge of coal in one retort would be passed through a second retort containing a nearly-exhausted charge. By this means, the under-distilled gas and tars from the fresh charge would be completely distilled by coming into contact with the highly-heated surface of the nearly-exhausted coal in the second retort. At the same time, the over-distilled gas from the nearly-exhausted charge would be protected from further decomposition by the tars and gases from the fresh charge of coal in the other retort. By the time the fresh charge is completely exhausted, the second charge has so far advanced that it will be undergoing perfect distillation in itself. The communication will be then cut off, which will cause the gas to pass off direct by the stand-pipe to the hydraulic main. As soon as the second retort has been discharged of the coke, and recharged with a fresh portion of coal, the communication would be again opened, and the under-distilled gases and tars from this fresh charge in turn made to pass through the now nearly exhausted coke from the previous charge; and so on reversing the current of gases each time of putting in a fresh charge of coal. By these means the gases might probably retain the full illuminating power, while being increased in volume, in consequence of over-distillation being prevented.

Mr. MONK said that at the Hamilton meeting he had fully expressed his opinion that Mr. Malam's process was the best thing which had come out for the last 24 years. He had been a reader of the JOURNAL for that time, and, although there had been many improvements in all parts of the apparatus for the manufacture and distribution of gas, there had been no improvement to show us how to take off 1500 to 2000 feet of gas per ton of coal carbonized, over and above that produced by working the method practised for the last 50 years; and it was only within the last few months, by reading that part of the "Treatise" which was lately published in the JOURNAL, that he had become aware that "Burch" had used the quantity of incandescent coke in the retort 30 years ago, and therefore Mr. Malam's patent only consisted in the application of water to prevent the choking of the stand-pipes. His practice was to keep up the heats; to keep up the water to the proper water-line in the consumers meters; to keep down the pressure in the mains consistent with an efficient supply to the public; and to keep down the bad debts. If 1500 or 2000 feet per ton of coal could be got out of it by the "Malam" process (to use an expression of a member of the American Gaslight Association at the convention in Brooklyn, U.S., last year, on the naphtha process, whereby a saving of 33 per cent. was claimed over the old process), so he said, *right here*, in the town of Lanark, where they had had the advantage of a ten years bitter competition through the establishment of a consumers company, and found their present capital £1 to 5s. of income per annum, whereas before the competition the old company had £1 income to £1 of capital per annum; here, he said, of all other places in the United Kingdom, was the place where they were desirous of an increased yield per ton of coal, and hence his desire to get all the information on the subject. But he must first have definite details, from an uninterested source, that the expense of working the "Malam" process would give him an extra quantity of gas sufficient to induce him to adopt it.

Mr. YOUNG said: It is hoped that out of the many trials which are being made of the various ways of carbonizing, we will arrive at something good. My friend, Mr. Scott, of Musselburgh, continues to have great faith in his mode of carbonizing, although Mr. Malam's and Mr. Scott's processes have a similar aim, and although the one embraces a part of the other, yet Mr. Scott's system, if fairly worked out, has, I consider, certain advantages. He has the power of preventing over-distillation at any stage, by withdrawing spent coke from the water-trough. The incandescent coke, through which the gases have to pass, is constantly renewed, and the cooling of the coke produces steam, which, in passing up through the highly-heated coke, is decomposed, producing water gas, which, commingling with the rich gases, suspends an extra volume of the rich light-giving hydrocarbons, and adds to the total volume without necessitating the destruction of any part of the illuminants to do so. But there are also certain drawbacks to his process, which he yet hopes to overcome. Seeing that all these experiments are being made, I think we should wait results, and in the meantime do everything in our power to assist these gentlemen, who are doing what they can for the benefit of the gas world.

Mr. MONK observed that while he did not agree with Mr. Smith, of Aberdeen, he thought they were indebted to him for having been the means of raising discussion, which was what they wanted.

Mr. YOUNG thought it scarcely fair to doubt in the smallest the statements of Mr. Smith. Personally, he was perfectly satisfied that the results published were substantially correct. By Mr. Malam's process, as by any other, he quite believed that either 9000 or 12,000 cubic feet per ton could be got, the quantity being entirely dependent on the temperature at which the gas was produced.

Mr. MONK said he had been nearly two years in Lanark, and during that period had used 47 different kinds of coal and shale, but very few produced coke good enough for keeping up the heats, and he thought that where Mr. Smith had fallen into error in testing the "Malam" process was that he had found the heats very low, and having no better fuel to fire with, was unable to get a proper heat to test the process fairly, and it showed them this—that if they were not using a coal giving fuel to keep up a proper heat, it was no better than the ordinary system.

Mr. NELSON: What Mr. Malam wishes discussed in this new phase is that the ammoniacal liquor is not allowed to go to waste and produce loss. One point alluded to by Mr. Monk is that he does not believe Mr. Smith. (Mr. MONK: No, no.) If a thing *cannot* be true, what is the use of discussing it, or what is the use of experimenting? There is little good in the report, except to establish what Mr. Malam said. It goes further to prove that Mr. Malam, with all the defects urged by Mr. Smith, had better results than in his laboratory test, and 5 per cent. was not sufficient to allow for the working of a few pounds, compared with tons of coal. I am glad that a man of such eminent knowledge as Mr. Patterson should come forward in this matter. It is something to the credit of the gas profession that he should do so, in order to eliminate the truth that is in it, and set aside the error.

Mr. YOUNG: I wish to add just one remark—viz., that I do not think Mr. Smith is blameable for one thing or another. He left it entirely in the hands of Mr. Malam, so that he could have got proper results; and Mr. Smith was perfectly justified in testing the working of the apparatus as he found it. Mr. Malam should be working the proper heats constantly, so that come who may, and when they chose, they should find the heats within the proper limits to produce the desired results. Such evidently had not been the case when Mr. Smith visited his works.

Mr. MALAM: I was lately trying the coal which had been used by Mr. Smith, and got 1600 feet more than he got. He simply allowed me 5 per cent., which was 10 or 15 below the mark he should have given me.

On the suggestion of Mr. GILCHRIST, the discussion was adjourned, Mr. Malam receiving the thanks of the association for his interesting paper.

(To be continued.)

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

A general suspension of business for several days commenced on Saturday last, very few manufactories being reopened before Wednesday or Thursday morning, and in not a few instances the whole week has been kept as a holiday. The Whitsuntide holiday is the principal one of the year, and there have been few symptoms of a lack of enjoyment, as a consequence of the quietude of trade, on the part of the working men. It is to be feared, nevertheless, that the greater part of their savings are very frequently thrown away in foolish wagers as to the result of the seductive "handicaps" which take place here. On Monday and Tuesday it is calculated that some 65,000 or 70,000 persons paid admission to the place where the running went on, a large section of the whole being miners from the surrounding Yorkshire, Derbyshire, and Nottinghamshire districts.

As a natural sequence to this general relaxation from labour, very few business transactions are on record during the week; prices are, therefore, nominal in respect of pig iron, for which the following are the current quotations by Cleveland agents here:—No. 1 foundry, 61s.; No. 2 foundry, 59s.; No. 3 foundry, 56s.; No. 4 foundry, 55s.; No. 4 forge, grey, 54s.; No. 5 forge, mottled, 53s.; No. 6 forge, white, 52s.; refined metal, 74s.; Kentledge, 65s.; and cinder pig, 43s., all net cash.

Early in the week circulars were issued by the Midland Iron Company, Limited, near Sheffield, notifying a reduction of 10s. per ton in the price of their merchant bars, making the amended quotation £9 10s. per ton delivered in Sheffield. The reduction has created a considerable impression in the trade.

The coal trade is still very quiet, but there is not, as yet, any official reduction in prices to announce.

IRON AND COAL TRADES OF SOUTH STAFFORDSHIRE AND EAST WORCESTERSHIRE.

(FROM OUR OWN CORRESPONDENT.)

Owing probably to the dulness of trade, the Whitsuntide holidays have this year been unusually prolonged, most of the mills and forges throughout the district having been standing idle during the whole of the week, the usual meeting of ironmasters was but thinly attended and the business transacted was of a very limited extent; makers of best branded iron report themselves fairly well supplied with orders, and prices for the leading brands are still maintained, but the common qualities of iron are again weaker, alike in the pig and finished departments. Cinder pig is now freely offered at £3 per ton, and good merchant bars at £8 7s. 6d. per ton.

Best sheets still command a moderately active inquiry, and makers of galvanized roofing sheets are well employed. The shipping trade is extremely dull, excepting on account of the colonial markets; but it is anticipated that now the northern ports of the Baltic are accessible, an improved demand will soon set in.

The coal trade, though to some extent upheld by the recent decision of the masters in the Cannock Chase district and by the labour difficulties in Warwickshire and North Staffordshire, is nevertheless growing much weaker. In the Wolverhampton district forge coal of good quality may be had as low as 9s. per ton at the pits, and commoner qualities are now on offer at 7s. 6d. per ton. It is considered probable, by those whose long experience with the trade entitles their opinions to respect, that the associated masters will shortly issue a revised list.

Around West Bromwich the ironfounders experience steady demand for gas and water mains and the heavier classes of produce, and are unable to satisfy the demands made upon them for prompt deliveries, and in some instances much inconvenience has been caused by the delay.

The wrought tube and fitting trades at Wednesbury do not yet present any features, and many of the operatives in that branch of industry are unable to find employment. Makers still complain of the severity of foreign competition.

In the Stourbridge district most of the leading brick yards are maintained at full production, and the demand for retorts, crucibles, and other specialities is above the average at this season of the year.

THE COAL AND IRON TRADES OF LANCASHIRE.

(FROM OUR OWN CORRESPONDENT.)

Business, both in the coal and iron trades of this district, has during the Whit-week been almost suspended, and there is very little to report in the way of trade. Most of the iron-works in the neighbourhood of Manchester were closed on Wednesday, and do not reopen until the middle of the present week, and there has been very little doing at the local collieries.

So far as the coal trade is concerned, there appeared to be, for the day or so prior to the holidays, a slight tendency for improvement; orders were coming to hand more freely, and prices were a trifle steadier. In the gas coal trade there was also more animation, and a fair number of contracts have now been entered into, at prices ranging from 12s. to 13s. per ton for good screened coal at the pit mouth.

The iron trade, so far as any report can be made, shows no sign whatever of improvement. Prices, both for Lancashire and other brands of pig iron, are weaker, and consumers are only buying to cover their more pressing wants.

No action has yet been taken with regard to colliers wages, but a reduction before long is now considered inevitable, and 15 per cent. is beginning to be talked of in some quarters.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

A fair average business was done in coals at the pits of the North of England last week. The shipments were good, and the length of the turns showed that the demand was very well sustained. Gas coals, however, have not been so firm. The best collieries barely maintained full rates, and second-class pits had some difficulty in securing trade to keep them fully going. The principal shipments of gas coals abroad last week were to Cronstadt and St. Peteraburg by steamers. The downward tendency of household coals at the pits has been stayed by a slight improvement in prices in the London market. Steam coals of best quality command a fair amount of attention in the market, but second-class sorts, being subjected to a pretty smart competition from other mining districts, barely keep their prices up. Manufacturing coals are getting firmer; they show a slight improvement in price. Coke is very firm, and not only are large quantities sent to the iron-works in the Cleveland district, and also placed aboard ship for the Continent, but some 60,000 tons per week are sent per rail to the West Coast.

The coasting freight market is quiet. Rather less money was paid to vessels taken on to load for the Eastern and British Channel ports. About 6s. 3d. per ton was paid to small vessels to load coals for London, and from £8 to £8 10s. per keel to the English ports in the British Channel. There was also a fall of 5s. per keel on French rates; 7s. 3d. per ton is about the figure paid to small vessels to load fire-bricks for London. The steamers are taking somewhat less money than that, as the goods trade from the Tyne to London is not quite so lively as it was. A moderate amount of business is doing to the Baltic, and trade to the Mediterranean is quiet. Generally speaking, the freight markets in the coal ports continue to favour shippers.

The iron trade of the Cleveland district, on account of a settlement having been come to in South Wales, was again a little weaker last week. No 3 Cleveland pig was offered at 56s. per ton. In the finished iron trade there was very little business, but this may have arisen from the Whitsuntide holidays. Little work was done in the first three days of last week in consequence.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

Notwithstanding the reduction that has already been announced in the price of gas in Helensburgh, the gas reformers of that town, who have for some time been expressing their dissatisfaction with the condition of things, have issued the prospectus for the new or opposition gas company. The capital is to be £10,000, in shares of £1 each. The promoters of this new scheme state that they have received from the Town Council permission, under certain conditions, to open the streets to lay down pipes, &c., and in a note they add that gas consumers will find it their interest to support the new company, and should not be influenced by any reduction in price which the old company may now make in consequence of the present movement, and which reduction may be but temporary.

It may be of interest to gas managers, directors of gas companies, and members of corporation gas commissions to learn one or two facts regarding the contracts recently concluded by the Gas Committee of the Paisley Town Council for 13,000 tons of cannel coal. The offers made in all amounted to 314,000 tons, and from that quantity the selection was made. From 70 to 80 firms of coal-owners and coal merchants sent in offers, but those accepted were from not more than half a dozen of the offerers. The purchases are wholly from the Lanarkshire coal-fields, and the coals selected are of such a character as to yield on the average fully 10,000 cubic feet per ton of 29 standard candle gas on the analytical scale; and the resulting coke affords an average of 87 per cent. of fixed carbon, while about two-thirds of the whole give 92 per cent. I am not at liberty to name the contracting firms, nor yet the prices.

At the ordinary monthly meeting of the Forfar Gas Commissioners on Monday, the 17th inst., it was reported that contracts for coal had been accepted amounting to £2428 2s. 6d., or an average of £1 6s. 11d., the quality of the gas to be produced to be of the illuminating power of not less than 28 standard candles. With reference to a complaint lodged at the preceding meeting, relative to the quality of the gas and the charge made for it, the committee to whom the matter was remitted reported that "in every case the index of the meter was accurately taken down, and made out and charged in accordance therewith; and that the quality of the gas had at no time been so low as 18 candles, the minimum quality allowed by the statute."

The Irvine Gas Company have reduced the price of their gas from 7s. 6d. to 6s. 3d. per 1000 cubic feet.

At the annual general meeting of the Buckie (Banffshire) Gaslight Company, Limited, held on the 15th inst., it was resolved to declare a dividend at the rate of 5 per cent. for the past year.

The Hamilton Town Council are seriously considering whether or not they should acquire more ground for the prospective extension of the gas-works, and have remitted to the Gas Committee to consider the question and report.

At their last meeting, the Police Commissioners of Brechin had under consideration a report regarding the lighting of the streets. It seems that, during the past year, the quantity of gas consumed in the public lamps was 431,246 cubic feet, and that the cost was £155 15s., being an increase of upwards of 20,000 cubic feet as compared with the previous year, but a decrease in cost to the extent of £11 5s. 9d., owing to the reduction in price.

There is not much important information to send concerning the iron trade. Pig iron, during the past week, has been down at 63s.; at the close of the week, however, 63s. 9d. was paid. Shipments are much in advance of what they were at this time twelvemonth, and the stock in the warrant stores is increasing very decidedly. There are 122 blast-furnaces in operation, as against 72 at the same time last year.

Coals are very little altered in price.

MAIDSTONE.—PROPOSED PURCHASE, BY THE TOWN COUNCIL, OF THE GAS-WORKS.—The Town Council of Maidstone, at a special meeting on Thursday last, agreed to the following resolution:—"That a committee be appointed to inquire into the quality, price, and supply of gas for the borough of Maidstone; also to take into consideration the desirability of considering the provisions of the local Act and the incorporated Gas-Works Clauses Act, and the desirability of approaching the directors of the gas company with a view of acquiring the gas-works; and to report thereon to a future meeting of the Town Council." This resolution was proposed after a speech of very great length from Mr. Wells. While giving the board of directors credit for doing everything for the general benefit, he hinted that they had been spoiled by prosperity, and submitted that the general consumers and ratepayers of the town were entitled to a larger share in the prosperity of the gas company than they had hitherto received. He entered into a lengthy history of the company from its establishment in 1823, with a capital of £12,500, in shares of £50 each to the present time; and explained the proceedings under the Gas-Works Clauses Act of 1847. He said the present price of gas at Maidstone was now 4s.; but in 1864 it was 5s. 6d. to consumers who took a certain number of thousand feet. A movement was then made in the town, which resulted almost immediately in the price being reduced to 4s. It had since been at a lower figure than 4s. He instanced Southampton and Walsall, where he said the local authorities had, by taking over the gas-works succeeded in effecting a reduction in the price of gas, and making large profits. He believed that if the corporation took over the works, in less than 25 years they would be the unencumbered property of the town, and would very greatly increase the general prosperity.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION has been AWARDED to

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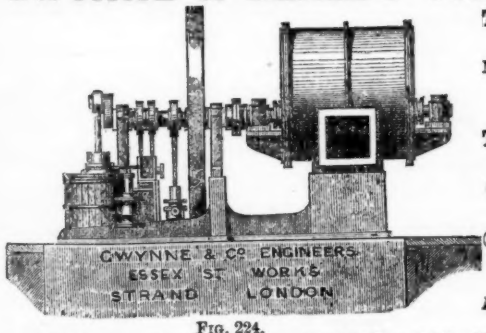

FIG. 224.

The BEST EXHAUSTERS IN THE WORLD.

Made under the personal superintendence of

Mr. BEALE,

The oldest Maker, Inventor and Patentee of

GAS-EXHAUSTING MACHINERY.

(It is NOT CORRECT to state that Mr. BEALE has RETIRED.)

Prices and every information on application.

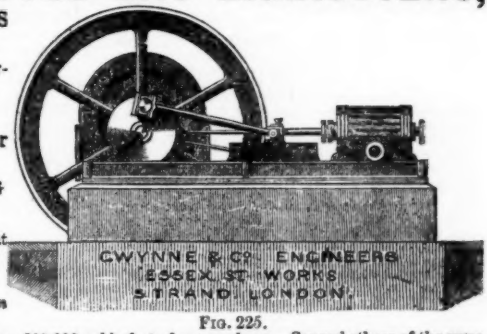

FIG. 225.

Fig. 224 represents one of those erected at the Imperial Gas-Works, Bromley, capable of passing 210,000 cubic feet of gas per hour. Several others of the same size are now on order for the same Company. These Patent Machines combine the highest quality of workmanship and materials, the largest bearings and wearing surfaces, with the **most perfect system of action yet discovered.** Fig. 225 represents one of a series of four at the Nottingham Gas-Works, each passing 52,500 cubic feet per hour. GWYNNE AND CO. *do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality, and the most approved design and arrangement.* Their prices have been estimated with a due regard to the **excellence of the article produced,** and when this is taken into consideration, they have no fear for the result. The orders executed this season for Exhausters and alterations to their patented system amount to over 4,000,000 cubic feet of gas passed per hour, and to over 300 horse power for Engines to drive them. In every instance their work is giving the greatest satisfaction. Numerous testimonials and references can be given.

REGULATORS, BYE-PASSES, STOP-VALVES, GAS-VALVES, & MACHINERY FOR GAS MANUFACTURE, OF ALL SIZES,

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G. & Co. are now manufacturing for a London Gas Company three of their 210,000 *cubic feet Patent Gas Exhausters, and many of all sizes.*

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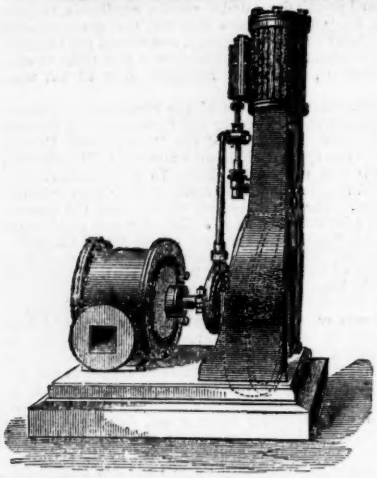
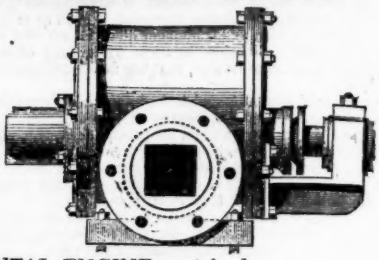


WITH

ENGINE COMBINED

ON

ONE BASE PLATE.



SOLE MAKERS,

GEORGE WALLER & CO.,

Who, since Mr. BEALE'S retirement, are the Oldest Makers.

EXHAUSTERS with HORIZONTAL ENGINE combined.
EXHAUSTERS with OUTSIDE BEARINGS.
MAKERS of ENGINES, BOILERS, and GAS MACHINERY.
TAR, LIQUOR, and SYPHON PUMPS. GAS-VALVES in stock, 2 to 30 inches.
SELF-ACTING BYE-PASS VALVES, with Lid and Relieving Lever.
MANN'S and many other descriptions of WATER DISTRIBUTORS.
SCRUBBERS, PURIFIERS, and CONDENSERS.
EXHAUSTERS from 3000 to 60,000, new and second hand, in stock.

PHŒNIX ENGINEERING WORKS, HOLLAND STREET, S.E., & at STROUD, GLOUCESTERSHIRE.

D. BRUCE PEEBLES & CO.,

ENGINEERS,

FOUNTAINBRIDGE WORKS, EDINBURGH,

MANUFACTURERS OF WET AND DRY GAS-METERS;

Patentees and Sole Manufacturers of PEEBLES' LAMP-GOVERNORS,

ABOVE 30,000 OF WHICH ARE NOW IN USE.

"These Lamp-Governors are so superior that they are likely to supplant all others."—*Dr. Wm. Wallace, F.R.S., F.C.S.*

D. BRUCE PEEBLES AND CO., FOUNTAINBRIDGE WORKS, EDINBURGH.

LOUGHBOROUGH GAS-WORKS.

WANTED, a Captain Stoker. Wages 30s. per week.
Apply to J. B. BALL, Manager.

WANTED immediately, two good second-hand PURIFIERS, from 5 to 7 feet square; also Condensers.
Apply to E. HIORNS, Secretary, Gas Company, Woodstock, OXON.

WANTED, a Working Manager for a small country Gas-Work. Good salary. Free house, firing, and gas.
Apply to Messrs. STROUD AND CO., 19, Osnaburgh Street, Regent's Park, LONDON, N.W.

NEW EDITION, NOW READY,

ADVANTAGES OF GAS FOR

COOKING AND HEATING.

By MAGNUS OHREN, A.I.C.E., F.C.S.

For Companies to issue to their Gas Consumers.

Specimen Copy by post Threepence, direct from MAGNUS OHREN, Gas-Works, Lower Sydenham, London, S.E.

FOR SALE—Two Purifiers, 9 ft. by 5 ft. by 3 ft. 4 in. deep; also Annular Condenser, with hoisting gear for purifiers, and 5-in. connexions for the whole. As good as new, and to be sold cheap.
Address J. WILSON, 82, EUSTON ROAD, N.W.

ON SALE, by Private Treaty, a small Gasholder, Retort, Purifier, and usual fittings.
Apply to Tawd Vale Colliery Company, Limited, Skelmersdale, near ORMSKIRK.

ON SALE, one Telescope Gasholder, girders and columns, to be removed by the purchaser at his or their own risk and expense. Dimensions of holder, top lift 38 ft. 6 in. by 18 ft., and bottom lift 40 ft. by 17 ft.
Sealed tenders to be addressed "Chairman of the Gas Committee, Macclesfield, Alderman W. Carr," not later than May 31, 1875.
The holder can be seen by applying to JOHN HENRY LYON, Manager, Macclesfield Corporation Gas-Works.

ON SALE, at the Doncaster Corporation Gas-Works, a STATION-METER complete, with clock, bye-pass, and hydraulic valves. Also a Governor, with two 10-in. slide-valves. These apparatus are to be sold solely in consequence of being too small for present and future use in their present situations.
The Station-Meter is in good repair, was made by West and Gregson, and has worked most satisfactorily to the present time, passing occasionally 12,000 cubic feet per hour.
The Governor is in good repair, and has worked quite satisfactorily to the present time, regulating the supply of gas for a consumption of 250,000 cubic feet per day of 24 hours.
Tenders for the Station-Meter and Governor, either together or separate, to be addressed to Mr. Alderman Dunhill, Chairman of the Gas Committee, on or before the 10th day of June next, endorsed "Tender for Station-Meter," or "Tender for Governor."
The undersigned will give any information as to the quality of the two instruments.—By order,
SAMUEL DARWIN, Engineer and Manager.
May 7, 1875.
The Committee do not bind themselves to accept the highest or any tender.

FOR SALE—Four Dry Lime Purifiers, each 10 ft. by 8 ft. by 3 ft., with 8-in. connexions, centre-valve, lifting apparatus, &c., complete.
Particulars may be had on application to G. E. SAVILLE, Manager, Gas-Works, SOWERBY BRIDGE.

FOR SALE—Two Gas-Works in a thorough good working condition. At present let to a responsible tenant for a term of 7 or 14 years. A good investment for about £3200.
Apply to No. 155, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

BOG IRON ORE.

PROPOSALS will be received for Bog IRON ORE, f.o.b. in a port in Donegal, in quantities as may be agreed on.
Address, A. B. C., Ramelton, Letterkenny, IRELAND.

TAR.

THE Undersigned are prepared to pur- chase TAR for cash, in large or small quantities. Distance no object.
Address HAMILTON, MACBEAN, AND CO., Tar-Works, Black Horse Bridge, Surrey Canal, Deptford, LONDON, S.E.

TAR AND AMMONIACAL LIQUOR.

THE Directors of the West Kent Gas Company are prepared to receive TENDERS, for One, Two, or Three years, for the surplus TAR and LIQUOR made at their works, at Erith and Crayford.
Tenders to be sent in, on or before May 29, to the Secretary,
R. P. KEYS.
237, Southwark Bridge Road, S.E.

PURIFIERS FOR SALE.

THE Cardiff Gaslight and Coke Company have for SALE four 12-feet square PURIFIERS, complete with wood sieves, wrought-iron covers, and convenient gear for raising; also faced centre-valve, with 15-in. connexion-pipes, all in thorough good condition.
May be seen at the works, or further particulars upon application.
HENRY BOWEN, Engineer.
Gas Offices, Cardiff, March 24, 1875.

THE Directors of the Wareham Gas Company are prepared to receive TENDERS for the supply of 120 tons of Pelaw Main, North Pelton, or New Pelton GAS COALS (best quality), to be delivered free of charge into lighters, at Russell Quay, at any time before the 1st of September next.
Payment for the same will be made two months after the 1st of September next.
Tenders to be sent in to my office on or before the 8th of June next.
F. FILLITER, Secretary.
Wareham, Dorset.

TAR.

THE Directors of the Brentford Gas Com- pany are prepared to receive TENDERS for surplus TAR (about 400,000 gallons per annum) made at their Brentford and Southall works. Contract to commence on the 16th of August, 1875, and to be for One, Two, or Three years.
Particulars and form of tender may be obtained on application to FRANK MORRIS, Engineer to the Company, at BRENTFORD.
Tenders to be sent in on or before the 27th of May.
The Directors do not bind themselves to accept the highest or any of the tenders.

AMMONIACAL LIQUOR.

THE Directors of the Barnsley Gas Com- pany are prepared to receive TENDERS for the AMMONIACAL LIQUOR produced at their works in Barnsley, and at Old Mill, for a period of One or Three years, from the 1st day of July next.
Probable quantity, and any other particulars, may be had on application to the undersigned.
Tenders, addressed to the Chairman, to be sent to me not later than Thursday, the 3rd day of June, 1875.
JOHN HUTCHINSON, Manager.
Gas Office, Barnsley, May 22, 1875.

GAS TAR.

THE Directors of the Ratcliff Gaslight and Coke Company are prepared to receive TENDERS for the TAR produced at their works, New Crane, Wapping, London, E., for One year, from the 1st day of July, 1875.
All particulars may be obtained on application to the Engineer at the works.
Tenders, marked "Tender for Tar," must be sent to the Secretary on or before the 31st day of May, 1875.
The Directors do not bind themselves to accept the highest or any tender, and may require security for the performance of the contract.
345, Cable Street, E., May, 1875.

GAS LIQUOR.

THE Directors of the Ratcliff Gaslight and Coke Company are prepared to receive TENDERS for the AMMONIACAL LIQUOR produced at their works, New Crane, Wapping, E., for One year, from the 1st day of July, 1875.
All particulars may be obtained on application to the Engineer at the works.
Tenders, marked "Tender for Liquor," must be sent to the Secretary, on or before the 31st day of May, 1875.
The Directors do not bind themselves to accept the highest or any tender, and may require security for the performance of the contract.
345, Cable Street, E., May, 1875.

TO IRONFOUNDERS.

THE Directors of the Preston Gas Com- pany invite TENDERS for the erection of Four sets of CONDENSERS and ten Purifiers, with the necessary centre-valves, traps, &c.
Plans and specifications may be seen at the Office of the undersigned, or copies of same will be forwarded on receipt of two and a half guineas.
Sealed tenders, endorsed "Tender for Purifiers, &c.," must be delivered on or before Saturday, the 5th day of June next.
HENRY GREEN, Engineer.
Gas-Works, Preston, May 12, 1875.

HINDLEY LOCAL BOARD.

WATER-WORKS.

THE Local Board for the district of Hindley are prepared to receive TENDERS for a supply and delivery at Hindley of 3480 yards of 12-in. and 780 yards of 9-in. PIPES, together with Junction-Pipes and other special castings required.
Copies of specifications can be obtained, and plans can be seen, on application to the undersigned, on and after the 18th inst.
Tenders to be sent in on or before the 5th of June next, endorsed "Tender for Water-Pipes," and addressed to the Chairman of the Board.
The Board do not bind themselves to accept the lowest or any tender. By order,
STEPHEN HOLT, Clerk to the Board.
Offices, Cross Street, Hindley, May 13, 1875.

BRITISH
ASSOCIATION OF GAS MANAGERS.

ANNUAL MEETING OF MEMBERS.

CIRCULAR OF ARRANGEMENTS.

THE

TWELFTH ANNUAL GENERAL MEETING

OF THE MEMBERS OF THIS ASSOCIATION WILL BE HELD ON

TUESDAY, WEDNESDAY, & THURSDAY, the 8th, 9th, & 10th of June, 1875,

AT THE

LECTURE HALL OF THE LEEDS PHILOSOPHICAL SOCIETY,

PARK ROW, LEEDS.

JAMES PATERSON, ESQ., F.C.S., PRESIDENT,

Will occupy the Chair.

ORDER OF PROCEEDINGS.

TUESDAY, JUNE 8, 1875.—Morning Meeting.

The Chair to be taken at Eleven o'clock.

Inaugural Address by the President. | Admission of New Members.
Reading of Papers and Communications.

Evening Meeting.

A Lecture will be delivered at the Lecture Hall of the Leeds Philosophical Society, by A. VERNON HARCOURT, Esq., M.A., F.R.S., Lee's Reader of Chemistry at Christ Church, Oxford; Metropolitan Gas Referee, &c., &c.; On "Experimental Inquiries concerning the Purification and Illuminating power of Coal Gas." The chair will be taken at Half-past Seven o'clock.

WEDNESDAY, JUNE 9, 1875.

The Chair to be taken at Eleven a.m.

Reading of Papers and Communications, and the Transaction of other Business.
Election of Officers for ensuing Year, &c.

At Six p.m. the Members and Friends will dine together at the Queen's Hotel, Wellington Street, Leeds. Tickets for the Dinner, 7s. 6d. each, may be had from the Secretary, if taken on or before the 8th of June. After that date 10s. will be charged.

THURSDAY, JUNE 10, 1875.

An Excursion by Rail from Leeds to Ripon, thence by conveyances, to be furnished, to Studley Royal and Fountains Abbey, where a luncheon will be provided. Return by the same route and conveyances. This arrangement may be varied to suit contingencies.

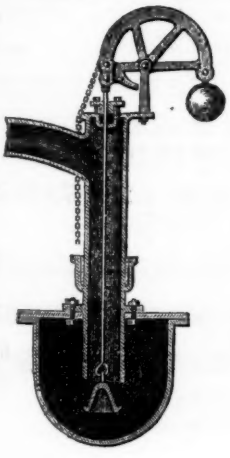
LIST OF PAPERS AND COMMUNICATIONS

TO BE SUBMITTED TO THE MEETING.

The Order in which the Papers are Read will be determined by the Committee prior to the Meeting, so as to suit the general convenience.

"Hills's Liquor Process for Purifying Gas." By Mr. GEO. LIVESEY, of London.
"Water Gas: Its Manufacture and Value." By Mr. R. P. SPICE, of London.
"Building and Heating Retorts." By Mr. GEORGE ANDERSON, of London.
"Retort Settings, with Special Regard to the Construction of Furnaces and Economization of Fuel." By Mr. JOHN TINDALL, of Walsall.
"A New System of Railway Lighting." By Mr. W. SUGG, of London.
"Systematic Testing of Consumers Meters." By Mr. JOHN DOUGLAS, of Portsea.
"Mechanical Stoking." By Mr. S. H. WARREN, of Crewe.
"Economy of Force in Gas-Works in Reference to Condensing, Exhausting, and Scrubbing." By Mr. WM. CLELAND, of Linacre, Liverpool.
"Station Governors for Gas-Works." By Mr. WILLIAM KEY, of Accrington.
"The Necessity of all Public Lamps being Supplied by Meter, and the Profits derivable from this System." By Mr. WM. BATES, of Worksop.
"Public Lighting." By Mr. T. A. SKELTON, of London.

May 22, 1875. WILLIAM H. BENNETT, *Secretary.*



BOX'S
PATENT ANTI-DIP VALVE

Affords a clear gas way through the dip-pipe while the retort is in action, and produces a perfect seal at pleasure, or whenever the retort is open, offering great security against the drawing of air, and obviating the necessity for using any liquid in the now so-called hydraulic main. It is easy of application to existing apparatus, and is comparatively inexpensive. Is not likely to get out of order, as the tar, which will adhere to the botton of the dip-pipe and the flange of the cone, both of which are faced, will act as a lubricant, and prevent undue wear and tear. The whole, as will be seen on inspecting the accompanying illustration, is exceedingly simple, and every part accessible. To adapt it to the present dips, all that is necessary is to face the bottom edge of the dip-pipe, and suspend a cone by a rod, which passes through the bonnet, the raising and lowering of the cone being performed through the intervention of a weighted eccentric.

The Patentee is prepared to supply Patented Apparatus upon the most moderate terms, and will be happy to reply to any inquiries that may by adddressed as under—

W. BOX,
GAS-WORKS, CRAYFORD, KENT

BAHIA GAS COMPANY, LIMITED.—NOTICE is hereby given that the ORDINARY HALF-YEARLY GENERAL MEETING of this Company will be held at the London Tavern, Bishopsgate Street, London, on MONDAY, the 31st day of May, 1875, to receive the Report of the Directors, the Balance-Sheet approved by the Auditors, and for general purposes.

The chair to be taken at Twelve o'clock precisely.

By order of the Board,
May 19, 1875. ALFRED J. HEAD, Secretary.

WOLSTON'S TORBAY IRON PAINTS.

THE Torbay and Dart Paint Company, Limited, 23, Great George Street, Westminster, S.W., having been informed that PAINTS not manufactured by them are being offered to Gas Companies and the public as "WOLSTON'S," hereby give notice that they will TAKE PROCEEDINGS against any persons infringing their rights as sole proprietors and manufacturers of Wolston's Torbay Iron Paints.

(See Advertisement on another page.)

GUILDFORD GASLIGHT AND COKE COMPANY.

TO CONTRACTORS.

THE Directors of this Company are prepared to receive TENDERS for the erection of a Wrought-Iron Roof, Iron Gutters, Rain Water Pipes, &c., at their works.

Plans and specification may be inspected at the Office of the Company.

Endorsed tenders to be forwarded to the undersigned, not later than Tuesday, the 15th of June.

By order,
JOSH. SHAW, Manager.
Gas-Works, May 22, 1875.

BLACKBURN GASLIGHT COMPANY.

TO ENGINEERS, METER MAKERS, &c.

THE Directors of the above Company invite TENDERS for the following APPARATUS required for the extension of their No. 2 Station, Addison Street, Blackburn.

Contract No. 1—For the supply and erection of a Wrought Iron Roof, Iron Gutters, &c., for a New Purifying House.

Contract No. 2—For the supply and erection of a Set of Four Purifiers 25 ft. square, and 4 ft. 6 in. deep, with dry centre-valve, connexions, lifting apparatus, wood grids, &c., complete.

Contract No. 3—For the supply and erection of a Square Station-Meter, to pass 60,000 cubic feet of gas per hour, with hydraulic valves, bye-pass, pressure and water-line gauges, &c., &c.

Drawings and specifications can be seen at the Company's offices (only), Darwen Street, Blackburn, from the 18th to the 26th inst.

Endorsed tenders to be forwarded to the undersigned not later than Thursday morning, May 27, 1875.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
W. B. EMMERSON, Engineer and Manager.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Oldham Corporation Gas and Water Works Committee are prepared to receive TENDERS for a supply of about 47,000 tons of CANNEL and COAL.

Particulars may be obtained on application to Mr. Herbert Andrew, Gas and Water Offices, Oldham.

Tenders to be sent in on or before Tuesday, June 8, 1875.

By order,
H. BOOTH, Town-Clerk.
Oldham, May 13, 1875.

TO COALOWNERS.

THE Directors of the Aylesbury Gaslight and Coke Company are open to receive OFFERS for the supply of 2000 tons of GAS COAL, from the 1st of July next, to be delivered at the London and North-Western Railway Station, Aylesbury, in such proportions as the Manager shall determine.

Each tender must be accompanied by a proper analysis of the Coal, and shall specify the pits at which it is raised.

The Coal is to be of the best quality, well screened, and free from bats, bind, refuse, and dirt. Any consignments not in accordance with this stipulation will be rejected by the Manager.

The Coal shall be weighed (20 cwt. to the ton) upon the L. & N.-W. R. Company's machine, Aylesbury, and paid for accordingly.

Sealed tenders to be sent, addressed to the Secretary, marked "Tender for Coal," on or before the 30th inst.

The Directors do not bind themselves to accept the lowest or any tender.

WILLIAM PARLBY, Manager.
Aylesbury, May 21, 1875.

BOLTON CORPORATION.—GAS DEPARTMENT.

CONTRACTS FOR CANNEL AND COAL.

THE Gas Committee are desirous of receiving TENDERS for CANNEL, and best GAS COAL or NUTS, in quantities of not more than 10,000 tons or less than 3000, for the year commencing the 1st of July next, to be delivered free at the Bullfield or Craddock Lane sidings of the Lancashire and Yorkshire Railway, at Bolton, or, if carted, at the Gas Street or Lum Street Works, as may be required.

Sealed tenders, endorsed "Tender for Coal," &c., specifying the Description of Cannel or Coal, the pits at which they are to be raised, and the quantities proposed to be supplied, to be sent to the undersigned, on or before Saturday, the 29th inst., stating also cash terms for monthly payments.

The Committee do not bind themselves to accept the lowest or any tender; but the person or persons whose tender may be accepted will be required to execute an agreement for the due performance thereof.—By order,

R. G. HINNELL, Town-Clerk.
Gas Offices, Bolton, May 10, 1875.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 42, Parliament Street, WESTMINSTER.

TENDERS FOR GAS COALS.

THE Directors of the Canterbury Gas and Water Company invite TENDERS for the supply of 5500 tons of best GAS COALS, to be delivered as follows:—

500	tons	during the month of	July next.
600	,,	,, ,,	August next.
600	,,	,, ,,	September next.
700	,,	,, ,,	October next.
800	,,	,, ,,	November next.
800	,,	,, ,,	December next.
800	,,	,, ,,	January next.
700	,,	,, ,,	February next.

Persons tendering to state the name and guarantee the description of the Coal proposed to be supplied, and the price per ton, either free on board, or delivered at the Contractor's sole expense into the Company's coal store, the weight in the latter case to be ascertained on the Company's weigh-bridge, and paid for accordingly.

Tenders, endorsed "Tender for Gas Coal," to be addressed to me, and delivered at the Company's Offices, Castle Street, Canterbury, before Ten o'clock in the forenoon of Friday, the 4th of June next.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
JAMES BURCH, Secretary.

May 21, 1875.

TENDERS FOR COALS.
SPECIFICATION.

THE Derby Gaslight and Coke Company are prepared to receive TENDERS for the supply of 24,000 tons of SOFT COALS and SOFT COBBLES or NUTS, to be divided into three contracts, of 8000 tons each; and to be delivered in the following monthly quantities, viz.:—

1875—	June	400
	July	400
	August	500
	September	900
	October	1000
	November	1000
	December	1000
1876—	January	900
	February	900
	March	500
	April	500
	Total of each contract	8000

The Company will undertake to receive from the party or parties contracting the total quantity of 24,000 tons, in one, two, or three contracts, as the Board may decide; but they do not bind themselves to accept the lowest or other tender or tenders, until after a satisfactory trial of the Coals and Cobbles or Nuts to which such tender or tenders may relate shall have been made. They are to be the best of their kind, and as free as possible from sulphur, bats, bind, refuse, and dirt, and shall be weighed upon a correctly adjusted machine.

Payments will be made monthly, if and so long as the contracts shall be duly fulfilled, to the extent of nine-tenths of the amount of the invoices, and the balance will be discharged on the satisfactory completion of the contract.

Sealed tenders (to be made on forms obtainable at the Company's Office), specifying the description of Coals and the pits at which they are to be raised, and stating the prices for delivery by canal at Derby at the new Gas-Works, adjoining the Midland Railway Company's premises, or at the canal wharf, and also the price delivered at either of the Midland Railway Stations, Derby, and in manner and subject to the conditions aforesaid, must be delivered at the Offices of the Company, Friar Gate, on or before Saturday, the 5th day of June next.

The respective contracting parties will be required to execute an agreement to be prepared by, and to the satisfaction of, the Secretary of the Company.

By order of the Directors,
ISAAC FISHER, Secretary.

Derby Gas Office, May 22, 1875.

Just published, price 10s. 6d.,

REGISTRATION OF DISTRIBUTORY PLANT.

The forms for this purpose are to illustrate the Paper on Distribution of Gas, read at the Edinburgh Meeting of the British Association of Gas Managers. By the use of the synopsis the whole of the out-door plant may at once be seen, with all matters pertaining to the same.

W. J. WARNER, Engineer.

South Shields.

BAILEY'S Patented Inventions are now in extensive use wherever steam is known. Bailey's Patent Steam Gauges, Pyrometers, Water Gauge Cocks, Test Pumps, Fusible Plugs, Steam and Water Valves, Safety Valves, Junction Valves, Pumps, Tell-Tales, Recorders, Lightning Conductors, Electric Telegraphs, Turret Clocks, Steam Joint Cement, Lifting Jacks, Boiler Feeders, Lime Catcher and Separator, Injectors and Ejectors, and every description of first-class Brass Work for Engines and Boilers. Gas-Works Managers who have not our large book should send for it.

16th edition, 1000 engravings, 4to., post free 2s. in stamps, weight 10 oz., cost of production £1000,

BAILEY'S Illustrated Inventions, containing details and prices of goods in our five several departments:—(1) Brass Foundry, Steam Gauges, Indicators, Feeders, and Fittings; (2) Engineers Sundries, Small Tools, and Stores; (3) Machine Pump and Fire Engine: (4) Turret Clock, &c.; (5) Electric Telegraph, A B C Instruments, Bells, and Apparatus.

J. BAILEY and Co., Albion Works, Salford, LANCASHIRE.

THOMAS ALLAN & SONS, of Springbank Iron-Works, Glasgow, manufacture small cast-iron GAS AND WATER PIPES, 1½ to 6 inches, at their branch works, Stockton-on-Tees, and have at present a large stock, which they are open to sell at moderate prices.

PATENT FUEL AND LIME FOR PURIFYING FROM FOUL LIME.

By a simple process the Foul Lime is converted into Fuel, by the combustion of which the lime is reproduced as a purifying agent.

Licences to work the invention will be granted to Gas Companies on very reasonable terms.

For further particulars apply to Mr. E. MADDOCKS, Manager of the Gas-Works, KETTERING.

The adoption of the above invention, without a licence from the Patentee, will be an infringement of the patent, and will subject the person or company guilty of such infringement to legal process.

Mr. ALFRED LASS,
60, CORNHILL, LONDON, E.C.,

Is prepared to open the Books, and, if necessary, keep the Accounts of Gas and Water Companies.

To examine the Books and Accounts, and prepare Balance-Sheets for the information of Directors.

To assist Secretaries in preparing Balance-Sheets, according to the "Gas-Works Clauses Act, 1871;" or may be consulted with respect to Accounts generally.

WM. RICHARDS,
INVENTOR OF THE DRY GAS-METER,
REVISER OF "HUGHES ON GAS-WORKS,"
CONSULTING GAS ENGINEER,

Advises on all matters of business connected with Gas Lighting, Furnishes Working Drawings of Retort-Settings, Specification of Works, complete or in detail.

11, ST. MICHAEL'S ROAD, STOCKWELL, LONDON, S.W.

CATHELS'S Patent District Dry Gas-GOVERNOR is the only perfect self-acting contrivance for Regulating the Pressures in the higher levels of a district.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, ROTHERHAM.

CATHELS & TERRACE'S Patent Four-WAY DISC GAS-VALVE is the simplest and best Valve for Purifiers, and as a By-pass for other apparatus in Gas-Works. It is always gas-tight, and has no springs, ground faces, or other delicate parts. By its use the flow of the gas cannot be accidentally stopped, and it never sticks.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, Foundry and Brass Works, ROTHERHAM.

WATER-MAINS.

COTTERILL'S PATENT STEEL TUBE-DRILLS, for connecting services to water-mains, *under pressure*, without turning off the water. They drill and tap themselves, and are left in the mains. Made of all sizes, from ¼ to 2 inches and upwards. They cost less than the ordinary plan.

Apply to CHARLES FOERSTER COTTERILL, Cannock, STAFFORD, Patentee.

OXIDE OF IRON.—We are prepared to supply, on moderate terms,
HYDRATED PEROXIDE OF IRON (BOG OCHRE),
Same quality as supplied by us to several of the most extensive Gas Companies, and which has given entire satisfaction.

FRANCIS RITCHIE & SONS,
BELFAST.

BIRTLEY IRON WORKS,
CHESTER-LE-STREET,
DURHAM.

Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.

Warehouse in London for Cast-Iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

Agent in London, Mr. J. MANWARING, 101 CANNON Street, E.C.

GARSIDE'S IMPROVED REGIS-TERED TUBE-VICE, holds all sizes of Wrought-Iron and Brass Tubes, from a 2-in. socket to the smallest brass tube made.

GARSIDES IMPROVED MAIN DRILLING CLIP, made in two sizes, to drill from 3-in. to 6-in. Mains, and from 6-in. to 12-in. Mains.

The above tools are made light and handy.

For drawings, &c., apply to the maker, SAMUEL GARSIDE, Gatefield Iron-Works, ASHTON-UNDER-LYNE.

E. GODDARD,
GAS-WORKS, IPSWICH,
SOLE AGENT FOR
EDGE'S PATENT
FOR REMOVING THE
CARBONACEOUS INCRUSTATION FROM GAS-RETORTS.

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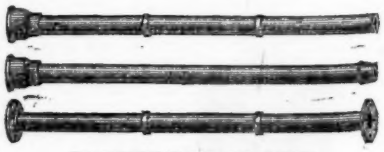

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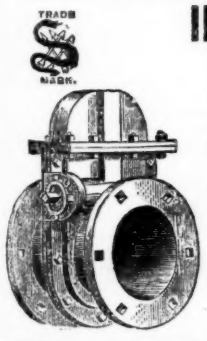

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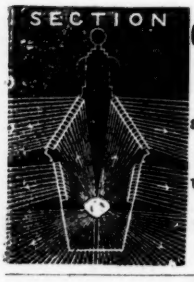

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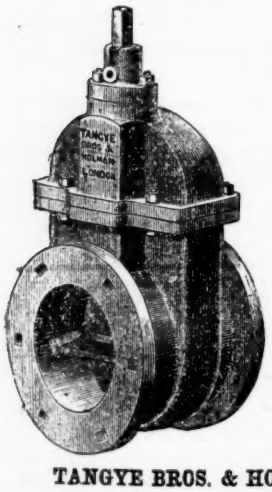

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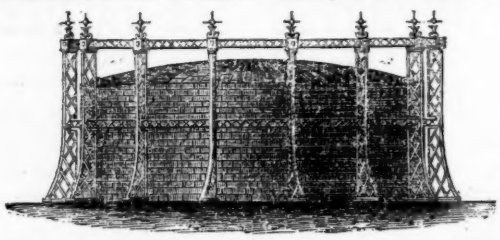

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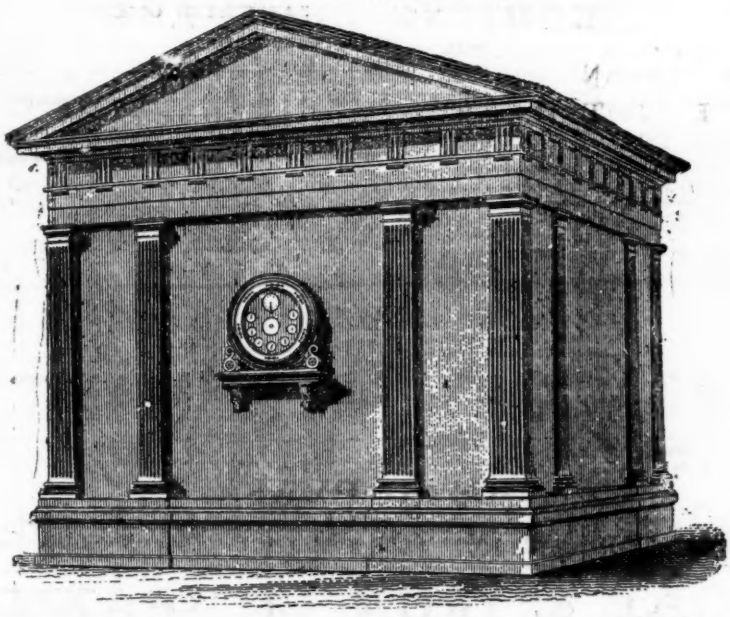

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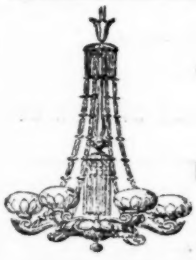

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(HEAD OFFICES: WIGAN, LANCASHIRE; DISTRICT OFFICE: 18, BENNETT'S HILL, NEW STREET, BIRMINGHAM),
WILLIAM M'GOWAN, AGENT,
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BEST WIGAN ARLEY MINE GAS COAL AND NUTS,
THE BEST HAND-PICKED ROUND CANNEL,
ALSO SMALL OR GAS CANNEL, ETC.
The Wigan Coal and Iron Company, Limited, incorporated 1865, are the exclusive owners of the well-known HAIGH AND KIRKLESS HALL COLLIERIES.

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STRONGLY RECOMMEND A TRIAL OF THEIR
CELEBRATED SILKSTONE GAS NUTS.
Analysis by F. J. EVANS, Esq., Chartered Gas Company, Horseferry Road, Westminster:—

(COPY.)

	Cubic Feet of Gas per Ton of Coal.	Illuminating Power in Candles.	Coke per Ton of Coal used.	Ash in Coke, per Cent.	Sulphur in Coal, per Cent.
Silkstone Nuts . . .	10·800	15·85	12·66 cwt.....	6·0	0·69

NOTE.—The illuminating power of the gas was tested by the standard burner now used in London by the Gas Referees, under the City of London Gas Act, 1868.

Horseferry Road, Westminster, March, 1870. (Signed) F. J. EVANS.

These Nuts are extensively used by various Gas Companies throughout the Kingdom, who bear strong testimony to their value.

APPLICATIONS FOR PRICES, &c., TO BE SENT DIRECT TO THE COLLIERY, AS ABOVE.

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Of superior quality, delivered at any station in England and Wales.

Purified gas per ton of coal in cubic feet (average)	**10,775**
Weight of coke in lbs. per ton of coal	**1,465**

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Mr. EDMUND TAYLOR, Secretary,

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This Company request attention to the very superior quality of their Cannel Coals.

1. The following are the practical results given by Dr. Wallace, of Glasgow, of analyses of their Lochore and Capledrae Cannels:—

	Sample worked at Capledrae.	Sample worked at Lochore.
Gas per ton of coal, at 60° Fahr. and 30 inches barometric pressure	13,095 cubic feet.	11,760 cubic feet.
Illuminating power, in standard sperm candles, by union jet consuming 5 cubic feet per hour, at ·5-inch pressure	32·91	34·83
Value of 1 cubic foot of gas in grains of sperm	780	836
Equivalent of a ton of coal in pounds of sperm candles	1,459	1,404
Durability of 1 cubic foot by 5-inch flame	69 minutes.	71 minutes.
Gravity of the gas (air = 1000)	596	594

Remarks.—This (the sample from Capledrae) is a Cannel Coal of first-class quality, giving 13,000 feet of 33-candle gas. It contains only a minute proportion of sulphur, and the ash is almost quite white. The coke is of rather inferior quality.

Remarks on Sample from Lochore.—This is a Cannel Coal of first-class quality, giving a large yield of very rich gas and a coke of medium quality.

2. The following are the practical results of analyses by Dr. Wallace of the Company's Waverley Cannels:—

	Capledrae Waverley.	Lochore Waverley.
Gas per ton of coal, at 60° Fahr. and 30 inches barometer	9,120 cubic feet.	11,145 cubic feet.
Illuminating power, in standard candles, by union jet consuming 5 cubic feet per hour, at ·5-inch pressure	36·62	33·09
Value of 1 cubic foot of gas in grains of sperm	878	794
Equivalent of a ton of coal in pounds of sperm candles	1,145	1,264
Durability of 1 cubic foot of gas by 5-inch flame	80 minutes.	67 minutes.
Gravity of the gas (air = 1000)	677	597

Remarks on the Sample of Capledrae Waverley.—This Coal gives fully 9000 feet of gas of 36½ candles, and is admirably adapted for bringing up the quality of gas made from common coal or inferior qualities of cannel. The tests were made at a rather high temperature, this being one of the coals that stand a very high heat without serious diminution of the illuminating power of the gas The coke contains 60 per cent. of ash, and is therefore almost valueless, but the proportion of sulphur is very moderate.

Remarks on the Lochore Waverley.—This is a first-class Cannel Coal, giving 11,000 cubic feet of 33-candle gas. The quantity of sulphur is very minute, and the ash is nearly white. The coke is of inferior quality, but not wholly valueless.

Applications for full Copies of Analyses and Prices may be made to the Company, at

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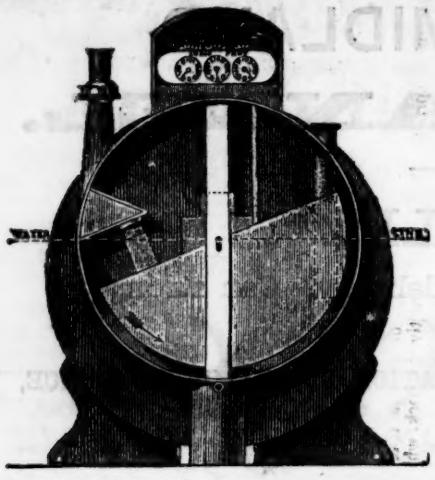

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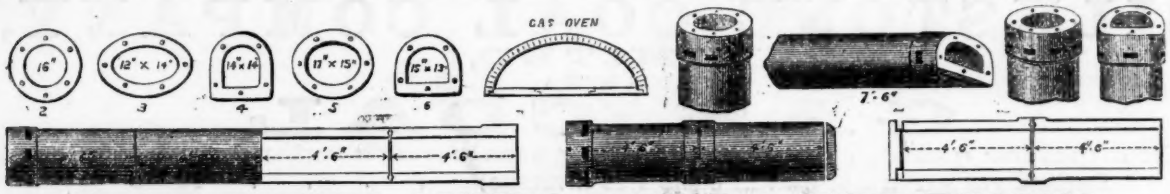

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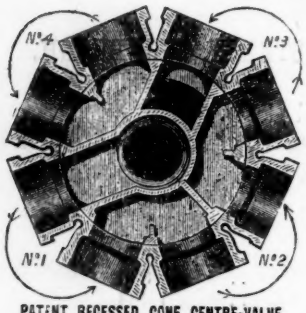

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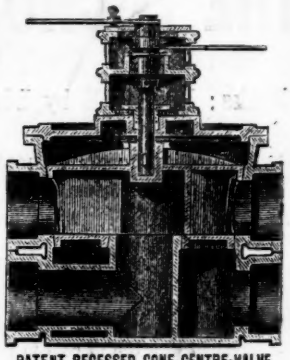

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